RAILROAD GAZETTE

MISLEADING STATISTICS.

Probably no one will question the statement that the purpose which Congress intended to serve in authorizing the collection, compilation and publication of railroad statistics by the Intersate Commerce Commission was the enlightenment of the people and their legislative representatives concerning the nature, conditions and methods of the great railroad industry. This being the case, it is worth while to consider what effect upon the public comprehension of railroad problems is likely to result from the widespread dissemination of the official synopsis of the forthcoming report of its statistician which has just been issued by the Interstate Commerce Commission. This abstract issued "for the press" contains about all that the average citizen will ever see of the work of the statistician. It goes to nearly every newspaper in the country and is liberally accorded space in the columns of the daily and weekly press. When, six or seven months later, the annual report for the fiscal year which ended with June 30, 1903, of which the document under discussion is an abstract, is published, the edition will consist of but a few thousand copies, and most of these will speedily be hidden on library shelves. The publication of the formal volume will receive no attention in the press, for its news value will have been forestalled by the abstract just issued. It is important, therefore, that the abstract should fairly epitomize the data which will finally appear; but on certain matters of great importance it fails to do so. The capitalization of railroad property should be an aggregate easily ascertained, since all that is necessary in order to determine it with accuracy is to add the capitalization of the separate corporations and to deduct from the sum the total par value of railroad shares and bonds owned by railroad corporations and thus duplicated in the first result. The facts necessary for this simple calculation will appear in the final report, but the present synopsis states the capitalization as $12,599,990,258 in the aggregate, and as averaging $63,186 per mile of line. The press synopsis does not show the amount of securities held by railroad companies, and consequently constituting a part of their assets. But even if these holdings were not increased between June 30, 1902, and the same date of last year, the real capitalization on the latter date was less by $2,208,518,793, or 17.53 per cent., than the amount shown, and the actual average capitalization per mile of line was $52,109 instead of $63,186. When public opinion regards railroad capitalization as excessive, as it is prone to do; when a widely prevalent prejudice conceives that this supposed over-capitalization is the cause of extortionate rates that are alleged to exist, and when not a few of those citizens who have been misled honestly believe that the aggregate par value of railroad securities has been increased with the deliberate purpose of defrauding the shipping and traveling public and deceiving legislative bodies, the promulgation by a Federal statistical agency of figures which exaggerate the capitalization of the American railroad system by over seventeen per cent. is quite unfortunate.

This, however, is far from being the sole instance of the presentation of data, or the omission of qualifying and significant facts, in such a way as to give to the synopsis the appearance of having been prepared without proper regard to fairness. The taxes exacted from the railroads by the various State and municipal governmets within whose jurisdiction their property is found, constitute an important and steadily increasing expenditure. In 1901 this item was $50,944,372, and in 1902 it was 6.91 per cent. more, or $54,465,427. The increase from 1902 to 1903 was substantially the same, or 6.21 per cent., to a total of $57,849,569; yet the item of taxes, which is thus equal to one-third of the income received by the holders of railroad shares, does not appear in the synopsis as a separate deduction from gross receipts, but is obscurely introduced as an element in the item of so-called "deductions from net increase," which also includes interest on funded debt and current liabilities, payments to lessors, and the cost of permanent improvements. In 1902 no less than 15.20 per cent. of the dividends paid on the capital stock of American railroad corporations was paid to other railroads which were the owners of the dividend-paying shares, and thus furnished the payees with resources from which to meet their own payments of interest and dividends. The dividends paid during 1902 on all railroad shares aggregated $185,391,655, but as $28,176,275 of this amount went to railroad corporations themselves, it is apparent that private investors received but $157,215,380, and that the latter amount is all that the railroads of the country, considered as a system, actually paid to their shareholders. The present synopsis repeats the higher figure and gives the corresponding amount for the year 1903, which was $197,148,576. It affords no reliable clue to the deduction necessary in order to arrive at the real payment to private investors for this purpose, but it is doubtful if this sum exceeded $160,000,000.

It is a thankless task to point out the deficiencies of an official report, and there can be little pleasure in noting the failure of any American public officer to realize the obligation of impartiality which goes with high public position. Yet it cannot be wholly useless to expose the misleading character of such a widely distributed and generally quoted document as that under discussion, and it should not be regarded as presumptuous to suggest to the statistician the desirability of including in it some of the facts which make the railroad side appear in a more favorable light, as well as all of those which are useful to the partisan "advocate of the small shipper."

THE TRAIN STAFF.

A correspondent asks us to describe the merits of the electric train staff and tell him what he can save, or what improvement he can make, by using it. He says, among other things:

> Wherein is the electric train staff superior to the controlled manual block system? Or to automatic block signals? The several accounts which have been printed in your paper describing the train staff have represented that the officers of the railroads where it is in use found great satisfaction in the improvement; yet they give very few particulars concerning its actual operation, and . . . one is left with the impression that there must be some feature of the subject which has not been fully dealt with. Is the field for this device as limited as would appear from the very brief list of American railroads using it?

The train staff is designed and used for single track, and should be first compared, not with the controlled manual or with the automatic, or even with the telegraph block system, but with the "American despatching system"—time-table rules for regular trains, when on time, and despatchers' orders for trains behind time and for extras. For either the automatic or the manual, controlled or uncontrolled, is prima facie in the same class with the electric train staff, and an intelligent comparison of these involves a close study of details; while in practice the staff (like the block system) has been used chiefly or wholly to cure the difficulties which are experienced with the American despatching system. In this system there are two principal faults—the danger of making a mistake in sending, receiving, delivering or executing orders, causing a collision; and the constant delays involved in writing, telegraphing, repeating and delivering written orders.

The electric train staff has a good reputation for curing both of these faults. The difference, in convenience or celerity, between the usual system and the staff may be roughly compared to that between the telegraph and the telephone. In telegraphing from New York to Boston or Philadelphia one may send a single message and get its answer in from 10 minutes to an hour or more. By the telephone a message may be started in five minutes or less, and the answer received at once; and from two to a dozen messages and their answers may follow within half that number of minutes. On the Cincinnati, New Orleans & Texas Pacific, at the Cincinnati end, where yard engines and other irregular trains are numerous, a half minute often serves to despatch an extra train on single track. The engineman draws up to the cabin and tells the staff operator his wish to go; and if the staff is not locked in the pillar (the fact that it is not locked indicates that the block is clear), the operator takes it out at once, uses it to clear the signal, hands it to the man on the train and the train proceeds. This Cincinnati installation, now of several years' standing, is in a situation to test any instrumentality for single-track working, as each single-track block-section lies between two double-track sections. The staff must survive on its merits; no blame for delays can be shifted to adjoining block-sections.*

The only definite statements that we have concerning the saving in time effected by the use of the staff are those from the Reading and the Atchison, published in the *Railroad*

*The electric train staff sections on the C., N. O. & T. P. are as follows: Cincinnati to Ludlow, across the Ohio River, about 1 mile; then double track through Ludlow yard; then another staff section 4.5 miles to Kenton Heights; then 2 miles of double track to Erlanger; then a staff block section 4 miles long to Dixon. The operators communicate with each other by telephones, and each one keeps posted so as to give precedence to the most important trains. These operators understand the power of the engines and the grades of the lines, so that they carry out the scheme very successfully, and they rarely have to call on the despatcher for an order to move a train. In the normal movement of trains the despatcher has no control whatever on this 13-mile section. For all ordinary trains the staff is delivered by means of a rubber hoop, which is practicable up to a speed of 35 miles an hour; while the faster trains have engines equipped with catchers.

Gazette Dec. 6, 1901, and Dec. 19, 1902. Neither of these will be found very satisfactory as a guide for calculating the probable saving at any other place. The Reading increased the capacity of a tunnel section 30 per cent., but we have no precise account of the procedure formerly employed. The Atchison made a large saving with freight trains (one hour in 23 miles), but the time consumed in giving train orders had formerly been excessive, because three and four enginemen had to be dealt with on each train, the grade of the line being so steep as to require helpers to that extent. But, whatever the *percentage* of time saved, it is certain that the electric train staff saves all that can be saved; for the second train desiring to use a section can always, at either end, and whether following or going in the opposite direction, get the right to the section the instant that the first one relinquishes it. No one has measured his aggregate saving; neither do we measure the savings accomplished by the telephone; yet everybody who uses a telephone saves time and brain-wear in such a marked degree that the change from old conditions forces itself on the mind almost every day.

For celerity, therefore, nothing can beat the electric train staff; not even automatic block signals (if depended upon by opposing trains, which they are not) would be more than half a minute quicker. When it comes to safety, everybody admits that the staff is to be classed as a block signal and that block signals are far ahead of the system that depends on the time-table, the time-interval, the time-piece, the despatcher, the operator, and the united action of the conductor's and the engineman's memories. The question is not between the "despatching system" and the staff, but between block signals and the staff; and this, as we have said, is too intricate a question to be settled in a paragraph, or a column. The train-staff principle, as exemplified in the old-fashioned English staff, without the electric improvement, is sui generis; nothing can fully take its place. It is a starting signal; having performed its function as such the starting-signalman is deprived of his power, and that power can be restored only by the voluntary action of the engineman for whom it was exercised. The electric staff preserves all the merits of the old staff, besides adding its own improvement, which virtually makes a single staff available at either of two places, miles apart, at the same moment. The only ground, we suppose, on which any one would think of questioning the entire accuracy of this assertion would be the possibility of imperfection in the machine. But, as careful signal engineers, who speak from intimate experience, have declared the electrical apparatus of the staff machine to be simpler and far more certain in operation than the electrical apparatus used in block signaling, it would seem to be reasonable to conclude that the staff apparatus is a reliable device; as simple and reliable, say, as the Morse telegraph, or the electric bells used in manual signaling.

Controlled manual block signals have not been much used on single track lines. The apparatus, if not as simple as that of the staff, certainly can be made so. The advantage possessed by the staff is its unique principle, already referred to. The advantage of controlled manual apparatus like the Sykes, is that the signalman does not have to get in touch with each engine as it passes. As compared with the simple manual or telegraph block system the staff and the controlled manual alike have the advantage of an electrical machine, simple and reliable, to control a fallible human machine.

Both the staff and the controlled manual are theoretically superior to automatic signals in having an attendant at each end of each block section, to watch for erroneous action, to hunt for defects when defects are indicated, and to co-operate in making each proceed-signal an assurance to the engineman that "all-clear" is given to him from both ends of the block section. That they are practically as well as theoretically superior, from a mechanical standpoint, is indicated by the fact that where automatic signals are used on single-track all the other safeguards against butting collisions are continued in force, the same as under the old régime, thus making of the automatic signals only an adjunct.

Besides celerity and safety there is the question of economy. If we take the position of the Railway Signal Association Committee (whose report was adopted) and decide that automatic signals are not suitable for single track; and if the despatching system is condemned by its slowness or its dangers, the question of economy lies between the controlled manual and the staff on one side and the telegraph block system on the other; and this resolves itself into the question whether the saving in time and the additional security against errors, as compared with the telegraph block system, are worth what it costs to put in and maintain the electrical apparatus. (The cost of apparatus to deliver staffs to fast-moving trains can be treated as a part of this.) As compared with the American despatching system, the saving in time is considerable, as has been shown. This saving has a definite money value unless the trains are so infrequent, slow and unimportant that delays are tolerable. As compared with the telegraph block system, the saving by the use of the staff should be much less, as each block signalman can learn the situation at the other end of the block section very quickly. To estimate for our correspondent how much it is worth to avoid errors we should have to have his collision record for a series of years and know the cost of collisions. If he is the superintendent, the value of his peace of mind would also have to be taken into account. Judging by the situation as it appears to us at present, we conclude that the staff apparatus costs so much that most of those superintendents who need it believe it their duty to get along without it a while longer. If their present system causes them anxiety—why that is what they are hired for!

The German Vice-Consul, at Nantes, reports a very unsatisfactory condition of the shipping and ship building industries in France, a matter which is of particular interest at this time because of the recent agitation for some kind of a bounty system for American shipping, to be constructed on a basis not unlike that which has been in existence in France since 1893. The consul says that the sailing ship companies which were called into existence at Nantes and Saint Nazaire by the mercantile marine law of 1893, are realizing very poor results in spite of the high navigation premiums, and he attributes this in part to the extremely low freight rates, and in part to the high price which had to be paid for vessels purchased or ordered to be built. The French bounty system seems to have failed entirely, so far as may be judged by the fact that the sailing ship companies, after ten years under the bounty law, are now in bad shape and are disposing of their vessels at extremely low prices. In 1903 the tonnage built at the yards at Nantes, Chantenay and Raze aggregated 15,675 tons gross, as against 56,237 tons in 1902 and 78,201 tons in 1901. In fact, the vice-consul, in concluding his report, says: "The artificial system of bounties, by means of which ship building and shipping traffic would, it was hoped, receive a mighty impetus, has, up to the present, had a most unfavorable effect." A bill was passed in France a year or so ago providing a payment for each day's active service of a French steamer built abroad, the benefit to be confined to modern ships. In commenting on the provision early in 1902, John White's Annual Shipping Review, published in London, expressed the belief that it would enable French owners to buy British ships and reap a bounty which, with the cheaper first cost of the vessel, would probably pay them better than the larger bounty for a French built ship costing more. The continuous depression in the ship building and ship owning trade, however, which has become very marked in recent years, affords a good forecast of the results which could be expected in this country if a promiscuous ship subsidy law were passed. The first result of such a law would, of course be over-production of vessels to earn the subsidy. These new competitors in a traffic already too well provided for, would have the inevitable effect of forcing down rates and with the prevailing high cost of American construction and high wages, it is easy to see that they would from the very first be placed in a position where they would have to depend on their bounties alone, not simply for profit, but for the very means of existence. The way this has worked out in France, where neither cost of building nor wages are as high as in this country, should afford a valuable object lesson.

June Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of June, printed in another column, contains accounts of 24 collisions, 20 derailments and 3 other accidents. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

	K.	I.
2d, Perry, Iowa	1	7
3d, Mastin, Kan.	1	19
20th, Campton, N. H.	1	6
25th, Tuttletown, Cal.	2	3
25th, Delaware, Ohio	2	2
27th, Dexter, Ohio	1	11
27th, Buffalo, N. Y.	2	11

The circumstances of these seven accidents require little comment in this place, other than that which, from the record, is obvious to every reader. Campton and Delaware are of interest as illustrating two very different kinds of trains. In the Campton case one passenger was killed and six injured by lumber which was pushed into a passenger

car, the train being a mixed one, freight and passenger. Running lumber next to passengers involves an obvious element of risk and it must be said that only the expected happened, the accident having been in other respects commonplace. At Delaware, on the other hand, the train was running at high speed and carried a large number of passengers, but all the cars in the train were of the latest and strongest construction, and they were of uniform design; no passengers were killed and only two seriously injured.

The number of electric-car accidents in June was 22; persons killed, 13; injured, 138. Of the 13 fatal injuries, ten occurred in two collisions, one at Wells Corners, near Norwalk, Ohio, on the 2d, and the other near Lima, in the same state, on the 23d. At Wells Corners, an eastbound "limited" passenger car of the Lake Shore Electric road met a westbound "package freight" car at full speed and six passengers in the smoking compartment, at the forward end of the passenger car, were instantly killed. It appears that the package car was behind time and that it had been ordered to meet the passenger car at Berlin Heights, a short distance east of the usual meeting point; and that this order was overlooked. At Lima, a light car, running between the city and McBeth Park, was entering a side track when it was struck by a heavy interurban car, which it was to meet at that point; and the injuries, fatal and non-fatal, counted up to more than twenty. The simple explanation of this collision is that the men on the interurban car thought that the other car had cleared the main line, but miscalculated. The Lima case emphasizes the danger of running heavy and strong cars on the same line with light cars, and in both cases a salient feature is that the passengers were in the most dangerous part of the "train." Discussion of the relative safety of different parts of a train or of a car may be unbusinesslike, and even unscientific, but there is no use in blinking the fact that the safety of passengers in a standard railroad train is to an appreciable degree dependent on the presence of one, two or more vehicles in the train ahead of the foremost passenger car. If the chances of being killed are to be compared, as between steam cars and electric, this condition must be taken into consideration. Formerly the rule to have a baggage car at the head of every passenger train (next behind the tender) was maintained with considerable strictness. Latterly it appears to be dropped out of mind, or to be definitely ignored, as in the case of one prominent trunk line, which regularly hauls many of its passenger trains ninety miles tail-end-first. This rule has lately been modified on the State railroads of Austria and Hungary by exempting from its requirement all trains running less than 29 miles an hour. In this country we seem to modify it according to what convenience may make desirable. Was the rule ever a reasonable one? Is it reasonable now? If reasonable now, what interest has the public in securing its adoption—or, rather, the adoption of the principle—on electric railroads? If the public has an interest, how ought it to be expressed?

The purchase by the New Haven road through its interurban sub-company, the Consolidated Railways Company of Connecticut, of the New London Street Railway Company, the Norwich Street Railway Company and the Montville Street Railway Company, is in rapid continuation of the recent aggressive policy of controlling interurban competition through ownership. These three new properties form a connected route on the west bank of the Thames River, from New London to Norwich, 10½ miles north, with short branches, paralleling directly the Central Vermont and indirectly the branch of the New Haven road on the east side of the river, which runs north through Norwich and Putnam to Worcester. The electric lines, however, only aggregate about 34 miles at present, part of which is in New London and Norwich. In view of the recent extensions of electric roads in the western part of the State, particularly in the vicinity of New Haven, Hartford, Bridgeport and Waterbury, it is rather singular that this little system, centering in New London and Norwich, constitutes at present the only electric mileage in the southeastern part of the State, including New London County and a greater part of Middlesex County, which adjoins it on the west and extends to a point on the shore of the Sound between Clinton and Madison. With the New London and Norwich lines as a strategic base, the New York, New Haven & Hartford is evidently in a position where it can prevent further encroachment on its territory along the sound east of New Haven. Extension of the New Haven system of electric lines east has at present only gone as far as Branford, nine miles from New Haven, out of the 50-mile stretch to New London, and with this control of the key systems at each end, the steam road would seem to be in safe possession of this suburban territory, which has been a constantly increasing source of short haul traffic within the last few years, particularly in the summer months. The important feature about the New London and Norwich purchase is that the steam road has taken over these potential competitors while they were yet in their infancy, and has secured its commanding position at small cost, instead of waiting until it should become necessary to deal with a fully organized and highly valued interurban system.

The Italian Government has until July 1, 1905, to make new contracts with the three great operating companies to which the State railroads were leased in 1885, to find new lessees, or to provide an organization for working them directly by the State. Both the State and the lessee companies gave notice that they would not renew the contracts on the old terms. The government announced to Parliament that it would prefer not to undertake the operation of its roads directly by the State; but as this may be necessary in case it is unable to lease on satisfactory terms, it has brought in a bill providing for an organization to work such lines as it may not lease. This organization is designed to keep, so far as possible, the railroad management out of politics, cabinet changes being frequent in Italy. There is to be an Executive Council and a General Manager, who together will have the powers exercised by the Minister of Public Works in most State railroad administrations; but supervision and inspection of the operation will be exercised by the Ministry of Public Works and of the finances and the accounts by the Minister of the Treasury. No elective officers may be paid officers of the railroad administration. Employees will be taken over provisionally from the present operating companies and secured the rights to pensions, salaries, etc., which they have acquired in such companies. All employees will be regarded as public officers, and as such subject to the provision of the criminal code, which declares that officials who leave their duties in consequence of an agreement of three or more of their number are liable to a fine of $100 to $600 and summary removal, and to loss of acquired rights to pensions. A special tribunal is established to hear and pass judgment on claims and complaints of employees, and in this tribunal the employees have a representative. The report accompanying the bill says that the aim is to make the railroad management as independent as possible, preserving to Parliament its power of supervision, the audit to the Court of Accounts and the inspection to the government.

NEW PUBLICATIONS.

Universal Directory of Railway Officials. 1904. Compiled from official sources under the direction of S. Richardson Blundstone, Editor of the *Railway Engineer.* The Directory Publishing Company, Ltd., 3 Ludgate Circus Buildings, E. C. London. Subscription price, 7½s. After publication, 10s. Sole representative for the United States, E. A. Simmons, 83 Fulton street, New York.

The tenth issue of this extremely valuable reference book is now at hand, containing, as in previous years, a carefully revised directory of railroads all over the world, including also practically all electric lines in the United Kingdom. The railroads are classified by countries and after the name of each road there is a statement of its mileage and of the number of locomotives, coaches and freight cars it owns. Then follows a full directory of the important officers and their addresses. These officers are also listed alphabetically in the back of the book, with a reference to the railroads which they serve and the page on which their names may be found. This publication is quite indispensable, not only for the addresses which it contains, but for the handy information about the physical characteristics of railroads in remote parts of the world, of which the official documents are not readily accessible.

TRADE CATALOGUES.

The July Bulletin of *The Buda Foundry & Manufacturing Co.*, Chicago, is devoted to Buda cars and wheels. Illustrations and descriptions of hand and push cars are given and a sectional view, with information, of the Buda steel wheel. The latter was tested by the University of Illinois in competition with another wheel and the results are given in the Bulletin. The Buda wheel was 12 lbs. heavier and required a load or 6,500 lbs. to cause permanent set, against 4,000 for the other. For relative stiffness, with the Buda as unity, the other was only one-seventh; that is, the load on the former was seven times that on the latter for equal amounts of compression. The Buda also showed superiority in the test for axle thrust. The report is summarized in the statement: "The Buda wheel is of the best form, considering strength, stiffness, side strength and general effectiveness."

A revised issue of the handbook (General Catalogue D) of the *Trussed Concrete Steel Company*, Detroit, Mich., is being sent out. This company controls the Kahn system for reinforced concrete. This handbook of 78 pages contains a complete description of the Kahn system and of numerous tests that have been made to determine the qualities of structures made in accordance therewith. Some of these tests have been described in the *Railroad Gazette.* The book also contains useful data relative to reinforced concrete designs, including tables of sizes and reinforcement for square panels, according to the Kahn system; also the method of calculation and tables for parabolic arches fixed at the springing and continuous over the crown. There are numerous engravings

and tables, and near the back a set of specifications for reinforced concrete.

The Westinghouse Electric & Mfg. Company, Pittsburg, Pa., sends us a pamphlet bearing the title "Machine Tool Drive." All users of machine tools will no doubt find this of interest, as it describes in detail the different methods of electric drives for machine tools, including alternating, direct current and three-wire balanced voltage systems. The book is handsomely illustrated throughout, showing the different applications of motor drives to machine tools. It also contains some very intresting comparisons, both financial and operative, between motor-driven and belt-driven tools.

The Westinghouse Companies' Publishing Department has just issued an illustrated folder which gives a brief history of the constituent companies controlled by the Westinghouse interests. It is illustrated throughout with half-tones, which show the products of the various companies. There are also a number of views given of the Westinghouse Companies' exhibit at St. Louis.

The Growth of the Missouri Pacific.

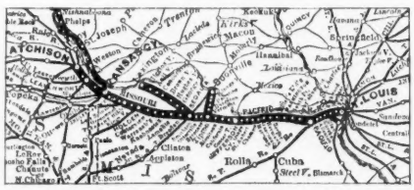
The Missouri Pacific, strongly intrenched within its territorial limits of traffic and aggressive in opening up and holding old and new competitive territory, is the keystone of the Gould railroad interests, and about it as a foundation has been built up a great system of closely allied railroads reaching from the Atlantic to the Rocky Mountains and controlling, almost single-handed, the large, undeveloped region to the south and west of the Mississippi. Jay Gould bought it, as he said, "to play with," but he and his associates gave it the start from which the younger generations of the Gould family have made of it a model railroad of its kind.

There have been two distinct periods in the growth of the Missouri Pacific. The original company, which built the line between St. Louis and Kansas City, was incorporated in 1849, and, with aid of State land grants, the road was opened through to Kansas City in 1865. It was 5 ft. 6 in. gage and ran through what was then a comparatively undeveloped country, in which what little traffic that originated was handled largely by the Missouri river packets. The road was changed to standard gage in 1871 and in 1872 was leased to the Atlantic & Pacific, which assumed all its numerous liabilities and guaranteed dividends on seven millions of the lessor's stocks. The Atlantic & Pacific carried its burden for three years, but in 1875 it defaulted its guarantee and the road was turned over to receivers for operation. Jay Gould, after his manipulation in Erie and the panic of 1873, was looking for some new plaything. His rival, William H. Vanderbilt, had worsted him in the battle for control of Erie and so he turned from the East, where he had failed, and sought out the obscure and unimportant Pacific Railroad of Missouri. The receivers of that road were only too glad to sell and Gould was willing to buy. For four millions he acquired a run-down railroad, 295 miles long, and after he had put in one of his famous "coördinate board of directors" he began to enjoy his new toy. He turned his energies, not to manipulating the stock on Wall Street, as he had done in Erie, for he and his associates owned all the stock among themselves and there was no one to "squeeze," but instead began to build up a system that in a few years became the largest collection of railroad mileage in the country.

The following statement of mileage owned and operated under lease for the period between the acquisition of the original Missouri Pacific in 1876 and the beginning of the second period of expansion in 1896, shows the remarkable growth of the system:

Year.	Miles owned.	Miles leased and operated.	Total.
1876	299	127	426
1878	296	127	423
1880	591	946	1,537
1882	1,853	4,024	5,877
1884	1,960	4,086	6,046
1887	3,743	3,261	6,974
1888	4,067	936	4,993
1890	4,353	772	5,125
1892	4,644	771	5,415
1894	4,332	1,046	5,378
1896	4,340	984	5,324

The increase in mileage during 1881 and 1882 was caused by the buying outright of the St. Louis, Iron Mountain & Southern and by the leasing on a basis of net earnings, of the Missouri, Kansas & Texas, the Texas & Pacific and the International & Great Northern. In addition to the mileage shown for 1884, the Wabash was held under lease to the Iron Mountain, so that the total mileage actually under the control of the Missouri Pacific aggregated about 10,000 miles. Many of the holdings of the company were poor and unproductive lines and the consolidation depended for its financial stability on the earning power of the parent company and one or two of the subsidiary roads which were in a prosperous condition. There



Missouri Pacific System in 1878.

was little or no unity in the organization beyond the duplication of directors and the looseness of the whole structure was fatal to any chance of building up a permanent and lasting system. Despite the efforts of the Missouri Pacific to hold the lines that had been acquired and to protect its position by heavy outlays for new construction, one by one the leased lines were turned over to receivers or reorganized as independent companies. First the lease of the Wabash and then the M., K. & T. with the I. & G. N. leases were abrogated for non-payment of rental during the years 1884 to 1888. During that time, however, many of the smaller branch lines were absorbed by a transfer of stock or securities and much new construction was completed, so that before the great industrial depression of 1892 and 1893 overtook the country the Missouri Pacific was in a position to weather the storm. As it was, dividends which had been paid regularly on a liberal scale were suspended in 1892 and all of the depleted income of the company was devoted to payment of interest on the floating and bonded debt. The very looseness of its organization saved the newly created Missouri Pacific from entire dissolution and bankruptcy.

The early history of the Missouri Pacific is interesting because it was the forerunner of the great railroad systems which have been built up within the last 10 or 15 years and which dominate the railroad situation to-day. It controlled the greater part of its mileage by leases, which implied no lasting obligation on its part, and which, on the contrary, gave little opportunity to weld the constituent companies into one strong organization under one management. Modern methods of consolidation are more intricate in their workings and more far reaching in their returns. Twenty years ago, when anti-trust legislation was almost unknown, the formation of such combinations as the first Missouri Pacific system was much simpler than at present, and much less safeguarded. Many of the failures and faults of that first "railroad trust," if it may be so called, have been avoided in bringing about the consolidations of such systems as the Pennsylvania, the Rock Island, the Southern and the Vanderbilt lines.

In 1892, when Jay Gould died, his son, George J. Gould, succeeded him in the management of the large railroad interests which he had acquired. Of the four roads in which his father had been a large stockholder, George J. Gould was made president of three—the Missouri Pacific, the International & Great Northern and the Texas & Pacific. The Wabash holdings were not materially increased and Gould simply retained his position as director.

The son's conception of the responsibilities that were imposed by the trust which had come into his hands was very different from his father's conception before him. The father had earned a hard reputation as a ruthless pirate of finance and wrecker of railroads. How well the younger Gould has earned the far more enviable reputation of a railroad builder is shown by the fact that to-day the system which bears his name is ranked among the six great railroad systems of the country, controlling, as it does, some 16,300 miles of road, capitalized at more than $675,000,000, and the backbone of the Gould System is the Missouri Pacific, which operates under one management 6,107 miles of track in nine States. In its treasury are the large holdings of stocks and bonds which insure control by the Gould interests of the other roads which go to make up the system. Any study of this group of lines must begin and end with Missouri Pacific.

The development of the Missouri Pacific since the depression of 1892 and 1893 has been characterized by a conservative and farsighted policy of betterments and rational expansion with a view always of holding such competitive territory as had been opened and anticipating the needs of the undeveloped portions of the Southwest by new construction designed to ultimately form important links in the existing system of main lines and branches. The aim has been to bring about operating conditions which would reduce expenses as much as possible and to make new business by extending branch and connecting lines through those parts of the contributory territory of the system which are undergoing a rapid development. In this the management has been ably assisted by the efficient efforts of the operating officials under it. The improvements made in grades, alinement, structures, rolling stock and motive power, each in themselves on a liberal scale, have combined to bring about such economical operation as to put the road on a dividend-paying basis and to provide funds out of income to carry on the betterment work and to pay for much of the new construction. It is the purpose of this series of articles to review the work which has been and is being done and the results which have been accomplished by the management during the last ten years.

In order to explain the reasons for improvements on some of the old lines and the construction of new lines, all of which are a part of a definite plan for enlarging the traffic possibilities of the system, it is necessary to briefly touch upon the relation of the various lines which go to make up the Missouri Pacific System, to each other and to

the traffic centers in the territory which they serve.

The main line of the Missouri Pacific is an east and west trunk line from St. Louis through Missouri and Kansas to Pueblo, Colo. Kansas City, Omaha and St. Joseph, the three centers of the Missouri River Valley, are all closely connected and through Southwestern Missouri, Kansas and Eastern Nebraska there is a network of branch lines, all of which contribute business for the main line. From St. Louis south, the Iron Mountain forms the other leg of a right-angled triangle through Arkansas to Texarkana, with numerous branches covering the territory between the main line and the Mississippi and continuing on down into Louisiana. If the system began and ended here its importance would be small in comparison with others in the same field. With its connections and allied lines all under close and friendly control, however, it dominates the Southwest and holds a firm grip on the region lying between Kansas City and Ogden. The Denver & Rio

Missouri Pacific System in 1884.

Grande and the Rio Grande Western control practically the entire western half of Colorado and the southern and eastern part of Utah, giving a direct line from Salt Lake and Denver to the western terminus of the Missouri Pacific at Pueblo. In the south the Texas & Pacific and the International & Great Northern reach out across Texas to the two important gateways of Mexico, El Paso and Laredo, and give entrance to the Gulf ports of Galveston and New Orleans. In addition to these the St. Louis Southwestern is in friendly hands and the Wabash, with its possibilities as an Atlantic and Mississippi trunk line, gives an outlet to the east from St. Louis and Kansas City.

The direction of traffic on the lines operated by the Missouri Pacific was, until a few years ago, east and west to and from St. Louis and north and south from the same point to and from Arkansas and Texas. The first steps in the improvement of the system were, naturally, to improve the condition of the track, roadbed and structures on the main lines to the west and south and put them in shape for heavier and faster trains. Between 1893 and 1897 all of the available income was expended in reballasting, laying new rail and replacing old bridges with modern steel structures and it was not until 1898 that heavy expenditures were begun for the real work of improving grades and alinement on the old lines and building new cut-offs and low-grade lines to overcome the worst difficulties. The generally improved physical condition of the system and the resultant economies in operation, together with the heavy increase in the business of the road following the depression of a few years before, provided income enough to carry on the proposed plan of betterments out of earnings. A careful and comprehensive scheme of improvements covering the whole system was laid out with a view of deriving the greatest benefits in operation in the least time with the smallest amount of interference to traffic. The plans made in 1897 and 1898 have since been carried out with some few changes and additions and the results in operation, as will be shown later, have already more than repaid the expenditures made.

(To be continued.)

Train Accidents in the United States in June.[1]

bc, 1st, Cumberland Valley, Scotland, Pa., butting collision between C. V. freight train No. 90 and a P. & R. freight, wrecking both engines and 14 cars. One engineman was killed and six other trainmen were injured.

†unf, 2d, Chicago, Milwaukee & St. Paul, Perry, Iowa, a passenger train was derailed by running into a washout and one passenger was killed and seven were injured.

bc, 3d, 7 p. m., Missouri Pacific, Mastin, Kan., butting collision between passenger train No. 1 and passenger train No. 36, wrecking the engines and front cars of both trains. A trespasser was killed and 18 passengers and one trainman were injured. The conductor and engineman of train No. 1 overlooked a meeting order which had been delivered to them.

*bc, 4th, Southern Railway, Harrodsburg, Ky., butting collision between freight train No. 62 and the engine of a work train, wrecking both engines and several cars. The engineman of the freight and one employee on the work-train engine were killed, and seven other employees were injured. The wreck took fire and was mostly burnt up. It is said that a flagman had been sent from the work train to stop the freight.

bc, 4th, Illinois Central, Horse Branch, Ky., butting collision of freight trains, both running at good speed, wrecking both engines and seven cars. One fireman was killed and several other trainmen were injured.

o, 4th, Southern Railway, Limestone, Tenn., the locomotive of a passenger train was badly damaged by the breaking of a side rod, and the engineman was injured.

bc, 5th, Detroit, Mich., butting collision between a passenger train of the Grand Trunk and an excursion passenger train of the Lake Shore & Michigan Southern; one fireman and two other trainmen were injured, the fireman fatally.

dr, 5th, Chicago, Indianapolis & Louisville, Rossville, Ind., an excursion train running at about 40 miles an hour was derailed at a defective switch, and the engine and several cars ran a considerable distance on the sleepers. The engine and baggage car were wrecked and the four passenger cars were derailed, but all of the 300 passengers escaped with slight injuries.

eq, 8th, Northern Pacific, Park City, Mont., westbound passenger train No. 3 was derailed while running at full speed and the engine and mail car were wrecked. The engineman, fireman and two express messengers were injured, and many passengers were cut by glass, which they broke in trying to escape from the cars. It is said that the derailment was due to the breakage of some part of the locomotive, the part falling to the ground.

dn, 8th, Southern Railway, Salisbury, N. C., northbound passenger train No. 40 was derailed at a misplaced switch and the engineman and fireman were killed; one other man was injured.

bc, 9th, Pere Marquette, Bay City, Mich., collision between an empty engine and some freight cars, doing slight damage. The engine, having been reversed and deserted, immediately ran backward some distance to a bridge, the draw of which was open, and fell into water 30 ft. deep.

xc, 10th, Western Maryland, Chambersburg, Pa., a coal train broke in two and the rear portion afterward ran into the forward one, wrecking five cars. Two trespassers riding on one of the cars were killed.

bc, 11th, Cleveland & Pittsburg, East Liverpool, Ohio, butting collision between a freight train and a gravel train; one employee killed, two injured.

eq, 11th, New York, Ontario & Western, Star Light, Pa., a freight train descending a steep grade was derailed by the breaking of a wheel, and 15 cars were wrecked.

rc, 12th, Minneapolis, Minn., collision between an excursion train of the Minneapolis & St. Louis and a train of empty cars of the Northern Pacific; two cars badly damaged; three passengers injured.

xc, 12th, 11 p. m., Watson, Ind., collision between an excursion train of the Cleveland, Cincinnati, Chicago & St. Louis and a passenger train of the Baltimore & Ohio Southwestern. Four passengers were injured.

unx, 13th, Chicago & Eastern Illinois, Danville Junction, Ill., several cars of a passenger train were derailed at a switch and the smoking car was overturned.[2] Eleven passengers were injured.

unf, 14th, 3 a. m., Kansas City Southern, De Ridder, La., passenger train No. 1 was derailed by running over a cow, and the engine and first two cars were ditched. The engineman and fireman were killed.

unx, 14th, Tennessee Central, Watertown, Tenn., passenger train No. 4 was derailed; one man injured.

unx, 15th, Cleveland, Cincinnati, Chicago & St. Louis, Indianapolis, Ind., passenger train No. 46 was derailed and the engine was overturned. Five trainmen were injured.

unx, 16th, Chicago, Burlington & Quincy, Mendota, Ill., passenger train No. 13 was derailed and the engine was overturned. The engineman and fireman were injured.

bc, 19th, 1 a. m., St. Louis & San Francisco, Sapulpa, I. T., butting collision between a freight train and an empty engine, badly damaging both engines and a trestle bridge. One conductor and one fireman were killed and one other trainman was injured.

xc, 19th, Baltimore & Ohio Southwestern, Vincennes, Ind., collision between passenger train No. 1 and a freight train; 13 passengers and three trainmen injured. It is said that the collision was due to a misplaced or defective switch.

xc, 19th, Shannon's Point, Mo., collision between a freight train of the St. Louis Southwestern and a passenger train of the St. Louis & San Francisco at the crossing of the two roads. The engineman of the freight and two tramps were killed.

‡20th, Boston & Maine, Campton, N. H., a mixed train was derailed and a passenger car and a car of lumber were badly damaged, and several passengers were crushed by lumber. One of these was killed and six were injured. It is said that the derailment was due to the breaking of some part of one of the trucks of the passenger car.

dn, 20th, Philadelphia, Baltimore & Wash-

[1] Accidents in which injuries are few or slight and the money loss is apparently small, will as a rule be omitted from this list. The official accident record published by the Interstate Commerce Commission quarterly is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defect of roadway.
eq	Derailments; defect of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

ington, Laurel, Del., a passenger train ran into an open draw at the crossing of Laurel River, and the engine fell upon a schooner in the river. The engineman was killed and the fireman slightly injured.

xc, 22d, 3 a. m., Illinois Central, Isley, Ky., a passenger train collided with the caboose of a freight which was on a side track but fouled the main track, and all of the passenger cars were damaged. The fireman was fatally injured.

unx, 22d, Houston & Texas Central, Austin, Texas, the locomotive of a freight train was derailed and wrecked; the engineman and two other trainmen were injured, the engineman fatally.

unx, 23d, Louisville & Nashville, Saxton, Tenn., a work train was derailed, and the caboose, in which were a number of laborers, was overturned; two of the men were killed and seven were injured.

†o, 23d, Lehigh Valley, Sugar Notch, Pa., The Black Diamond express train broke in two between the fourth and fifth cars, and a woman who was at that moment crossing from one car to another fell through and was killed.

bc, 24th, New York, Philadelphia & Norfolk, Bayview, Va., butting collision of freight trains, wrecking both engines and several cars. One engineman was killed and three other trainmen were injured. The wreck took fire and was mostly burnt up.

unf, 24th, Chicago, Rock Island & Pacific, Grayson, Kan., a passenger train was derailed by running over some cattle and the engine was overturned. The engineman and fireman were injured.

bc, 25th, Atchison, Topeka & Santa Fe, Fresno, Cal., butting collision of passenger trains, wrecking both engines and the forward cars of both trains. Six passengers and two trainmen were injured.

†rc, 25th, Sierra Railway, Tuttletown, Cal., a work train ran into the rear of a preceding passenger train, wrecking an oil car at the rear of the passenger train and forcing it half way through the passenger car which was next. Two passengers were killed and three were injured. The collision is said to have been due to the work train becoming uncontrollable on a steep, descending grade.

unx, 25th, Cleveland, Cincinnati, Chicago & St. Louis, Delaware, Ohio, a southbound passenger train running at high speed was derailed at a switch, and the engine, baggage car and one passenger car were overturned and ditched. The engineman and baggageman were killed and two passengers were injured.

unx, 25th, 9 p. m., Norfolk & Western, Myrtle, Va., a freight train was derailed and many cars were ditched and wrecked. Two tramps were killed and five were injured.

*bc, 27th, 4 a. m., Central of Georgia, Fort Valley, Ga., butting collision of freight trains, wrecking 14 cars of fruit and merchandise, which took fire and were burnt up.

bc, 27th, Kanawha & Michigan, Dexter, Ohio, butting collision between a passenger train and an empty engine. Three trainmen and nine passengers were injured, one of the trainmen fatally. The collision occurred at the mouth of a tunnel, and it is said that the smoking car was split open for half its length. The engineman of the empty engine forgot about the passenger train.

†xc, 27th, Buffalo, N. Y., collision between a freight train of the New York, Chicago & St. Louis and a train of the Delaware, Lackawanna & Western, at the crossing of the two roads. The Lackawanna train had on board several hundred workmen going to the steel works. One workman was killed and 12 were injured, one of them fatally.

xc, 27th, Chicago, Burlington & Quincy, Newcastle, Wyo., passenger train No. 41 ran over a misplaced switch and into a freight train standing on the side track, wrecking the engine and one freight car. Two men were injured.

unf, 28th, Wheeling & Lake Erie, Greenough, Ohio, a freight train was derailed by running into a landslide and the engineman jumped off and was fatally injured.

bc, 29th, Southern Railway, Culpeper, Va., a freight train collided with a work train, which, it is said, was not properly protected by flag, and both engines were wrecked. The fireman of the work train was killed and two other trainmen were injured.

bc, 29th, Minneapolis & St. Louis, Shakopee, Minn., butting collision between a freight train and a work train, due to a misunderstanding of orders. One employee was killed and six others were injured.

eq, 29th, Norfolk & Western, Glenvar, Va., a freight train was derailed by a broken wheel and 20 cars were wrecked. A brakeman was killed.

unx, 29th, Kansas City Southern, Joplin, Mo., a southbound passenger car was derailed and the baggage car and smoking car were overturned. Two passengers and two trainmen were injured.

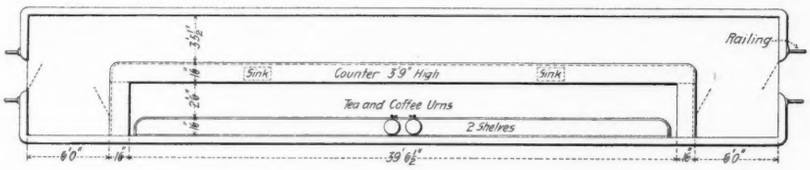
bc, 30th, Cincinnati, Hamilton & Dayton, Miamisburg, Ohio, butting collision of passenger trains, wrecking both engines and several cars. Three trainmen were injured.

o, 30th, Pennsylvania road, Ehrenfeld, Pa., the locomotive of a freight train was wrecked by the explosion of its boiler; three employees killed and two injured.

Lunch Counter Car of the Pere Marquette.

The Pere Marquette has a heavy week-end passenger traffic to Michigan resorts at this season of the year, the noon trains out of Chicago on Fridays and Saturdays being quite crowded. Sunday evening the heavy travel is in the opposite direction. The trains in this service have been carrying café cars giving à la carte service, but it was quite impossible to accommodate more than a small part of those wishing to patronize them. After some study of the matter in an effort to make some provision for meeting the wants of the hungry patrons without running several dining cars in each train, General Passenger Agent Moeller hit upon the idea of a lunch car patterned after the quick-service restaurants.

An old parlor car was taken and converted, as shown in the engraving. A counter 3 ft. 9 in. high, 16 in. wide and 42 ft. 2½ in. long, with extensions at each end running to the side wall, was built in the car, leaving 6 ft. of space at each end and 3 ft. 5½ in. along the side. Shelving, cupboards, lockers, etc., were built behind the counter along the wall of the car similar to the usual restaurant arrangement, with steam-heated tea and coffee urns, and with sinks, with hot and cold water, under the counter, and overhead water tanks at each end of the shelving. All of the woodwork, except the top of the counter, which is walnut, is pine, stained and finished to match the rest of the car. Railings are placed on each side of the car doors so that it can only be entered from adjoining cars.



Floor Plan of Pere Marquette Lunch Car.

Sixty people can stand along the counter, and there is room in the car for 150 or 200 persons. The service is in charge of the Heusner Baking Company, of Chicago, which has a number of restaurants in the city. The provisions are of the usual bakery lunch variety, and the prices are moderate. The car runs to Hartford, Mich., giving nearly three hours and a half in which to serve the passengers. It "deadheads" back Friday night, but on Saturday it remains at Hartford to be picked up by the Sunday evening train to Chicago, to serve the returning crowd. The regular café cars are also run in these trains for the accommodation of through passengers. Although the lunch car has been in service but a short time, it was an immediate success and is much appreciated by Pere Marquette patrons. We are indebted to Mr. W. E. Wolfenden, General Western Passenger Agent, for data.

Interior of Pere Marquette Lunch Car.

Block Signaling on the Chicago & North Western.

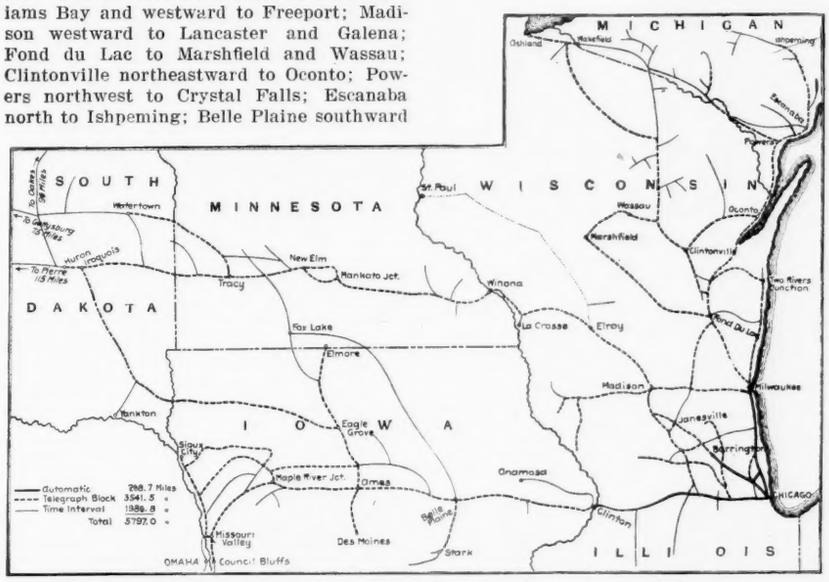
The Chicago & North Western has lately established the block system on certain of its lines in Iowa, and the total mileage now worked by the space interval is 3,810.2. An officer of the company has sent us a map which shows the whole of the company's lines and indicates the different methods of operation on different sections of the road. The map is self-explanatory. The automatic signals are all on the lines near Chicago, where is to be found the heaviest movement of traffic. The length of lines shown as worked by the telegraph block system is 3,541.5 miles, but on nearly one-half of this (1,639.5 miles) many of the offices are closed during the night and trains are run by the time interval, the block system being used only during the daytime. The lines of which the block offices are closed during the night are: Fox River switch northward to Williams Bay and westward to Freeport; Madison westward to Lancaster and Galena; Fond du Lac to Marshfield and Wassau; Clintonville northeastward to Oconto; Powers northwest to Crystal Falls; Escanaba north to Ishpeming; Belle Plaine southward to Stark; Jewell Junction southward and westward; Eagle Grove northward and westward; Tracy northward and westward, and a few short sections elsewhere.

Permissive block signaling is allowed as between freight trains, where necessary. On the 1,986.8 miles of less important lines, some of them having but few trains daily, the 10-minute time interval is used, and there is no block signaling.

The mileage signaled on each division is shown in the accompanying table.

SPACE INTERVAL AND TIME INTERVAL ON THE CHICAGO & NORTH WESTERN.

Division.	Automatic. D. T.	Telegraph, D. & N. D. T.	Telegraph, D. & N. S. T.	Teleg. Days. D. T.	Teleg. Days. S. T.	10 Mins. S. T.	Total Miles.
Iowa	138.1	350.4	....	..	59.2	149.6	559.2
Galena	138.1	....	11	..	156.9	150.9	456.9
Wisconsin	124.6	53.5	163.6	..	....	5.3	346.8
Madison	6.0	96.7	225.7	..	136.6	39.5	504.5
North Wisconsin	....	5.5	145.6	..	129.6	51.1	331.8
Sioux City	....	....	75.9	..	253.2	72.4	401.5
North Iowa	....	....	29.4	..	211.3	115.0	355.7
I. & M.	....	....	....	..	58.6	268.7	327.3
Minnesota	....	....	221.2	..	129.9	152.9	504.0
Dakota	....	....	....	8.8	124.8	188.2	436.7
Peninsula	....	8.7	106.2	..	262.5	547.1	809.6
Ashland	....	....	408.8	..	108.1	246.1	763.0
Total	268.7	514.6	1,387.4	8.8	1,630.7	1,986.8	5,797.0



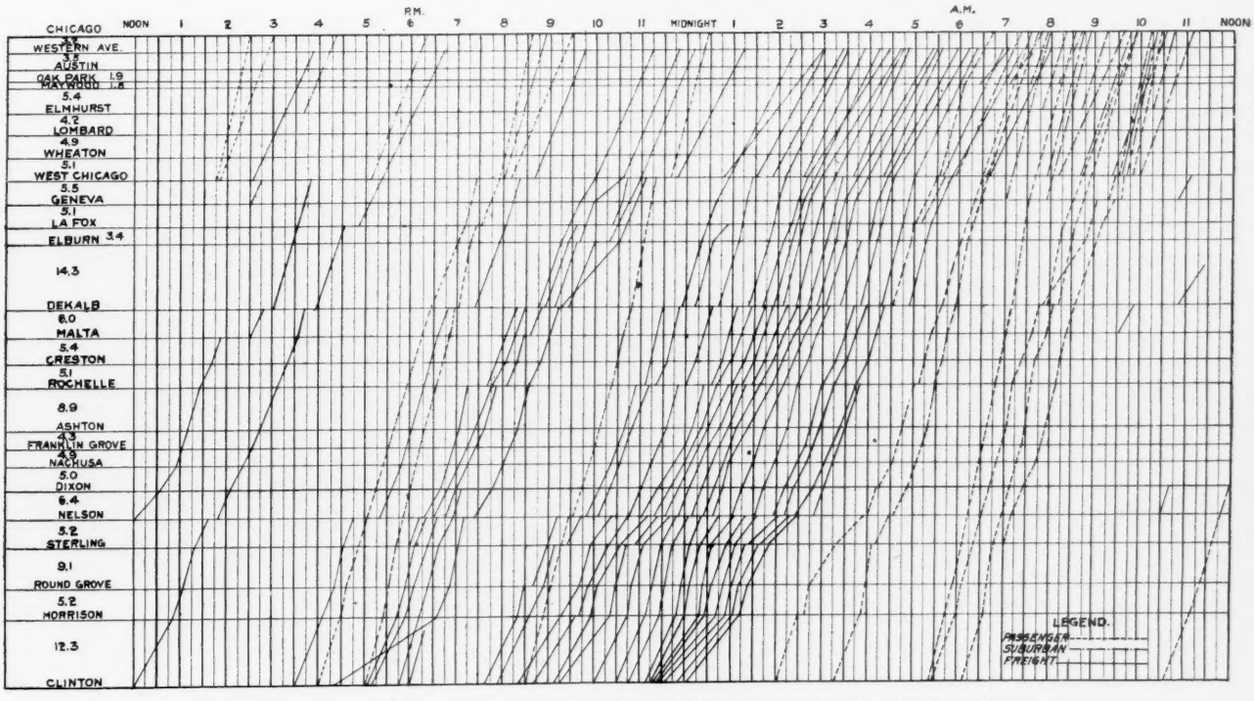
Block Signaling on the Chicago & North Western, June, 1904.

LIVE STOCK MOVEMENT.

The Chicago & North Western's line from Omaha to Chicago has for many years been one of the principal carriers of live stock to the latter city, and the uniformly good time and prompt delivery made has reflected much credit on the officers of the road. The movement is always heaviest at the beginning of the week, and deliveries at Chicago on Monday average 700 cars.

On a recent occasion, from noon of Sunday until noon of Monday, the number of stock trains arriving in Chicago by this line was 26, and of ordinary freight trains two. Adding the through and local passenger trains, the total arrivals were 57. The number of cars of live stock was 730, and of other freight 62.

The main line from Clinton to Chicago, 138 miles, is equipped with Hall automatic block signals (enclosed disks). These signals for most of the way are set from 6,000 to 7,000 ft. apart, so that during a heavy movement like that here referred to, the road is used continuously for many hours to its full capacity. To make a graphic exhibit of this movement a photograph has been prepared, from data given in the train despatcher's sheet, which shows approximately the relative positions of 36 eastbound trains throughout their movements from Clinton



Chicago & North Western Railway—One Day's Train Movements, Clinton to Chicago.

to Chicago. A reproduction of this photograph is given herewith. This drawing does not represent the traffic on the day above mentioned, and it does not represent the precise position of the trains at all points of their respective journeys, as the lines are in their true positions only at those stations which are shown at the left of the drawing; but the intervals between each train and the one ahead of it and the one behind it are indicated with a considerable degree of accuracy. At the time this drawing was made, that portion of the line between Clinton and De Kalb was worked by manual block signals. Permissive signals were given where necessary to avoid serious delays to trains, but there were not so many of these as would appear from the drawing, for the reason that there were more block-signal stations than appear in the illustration; some were omitted in order to avoid confusing the lines in the drawing.

Steel Car Design.

V.

BY A. STUCKI.

Box Cars with Load Carried by the Sides. Box cars with steel body framing can be designed so that the sides form a deep truss strong enough to carry all of the load, leaving the center sills to transmit only the end shocks and thus to become a backbone for the car. In the diagrams, Figs. 15 to 17, the usual forms of truss framing are shown, with the posts and braces arranged in the proper way for a car of the dimensions adopted as standard by the American Railway Association. The figures show the maximum forces, in pounds, in all of the members of the framing and were obtained by considering only those panels loaded, which, in each case, would give the maximum stress for the panel members. To cover the most severe cases and to allow for variations in the method of connecting the posts, braces and top and bottom members, the maximum allowable load for the 50-ton car was taken at 120,000 lbs. instead of the usual 110,000 lbs. and the weight of the body was assumed as 28,000 lbs. A theoretical height of panel of 100 in. was also assumed. On the diagrams, the heavy lines indicate compression and the light lines indicate tension. A low fiber stress should be chosen to allow for vibrations and vertical oscillation. The stresses in the top and bottom chords of the side trusses should not exceed 8,000 lbs.

The end pressure exerted by the load when abrupt changes in the speed of the car occur can be assumed as 10,000 lbs. at the top of the end framing and 20,000 lbs. at the bottom, for a 50-ton car and 80 per cent. and 60 per cent. of these values for the 80,000-lb. and 60,000-lb. cars, respectively. These forces, however, are usually taken up by members of the framing, which are not subjected to any great stress, and for this reason they have not been considered in calculating the stresses shown on the diagrams.

Since it is not possible to introduce diagonal braces in the door opening panels of the side trusses, an unsymmetrical load will create bending stresses in the top and bottom chords, the bending moment being

$$M = f \times \frac{\text{door opening in inches}}{4}$$

where f is the vertical component of the forces which would exist in the diagonal braces if they were introduced into the panel. The following are values of f for the three-capacity cars.

5,890 lbs. for 100,000 lb. cars with 2 intermediate doorposts.

5,119 lbs. for 100,000-lb. cars with 1 intermediate doorpost.

4,770 lbs. for 80,000-lb. cars with 2 intermediate doorposts.

4,147 lbs. for 80,000-lb. cars with 1 intermediate doorpost.

3,651 lbs. for 60,000-lb. cars with 2 intermediate doorposts.

3,175 lbs. for 60,000-lb. cars with 1 intermediate doorpost.

The bending moments in the top and bottom chords are shown on the diagrams and they are resisted by the continuous members, the deepest sections, of course, doing most of the work.

The posts and braces in addition to the direct tension and compression which they resist as members of the side truss, are subjected to cross-bending stresses induced by

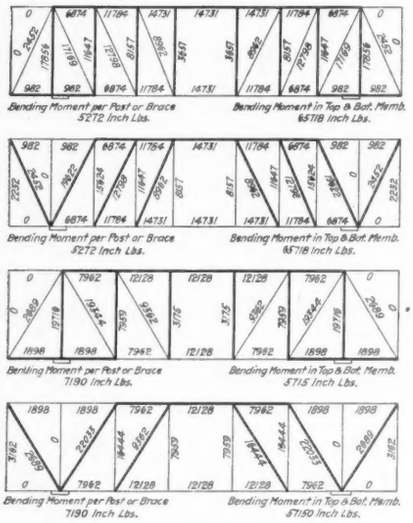


Fig. 15.

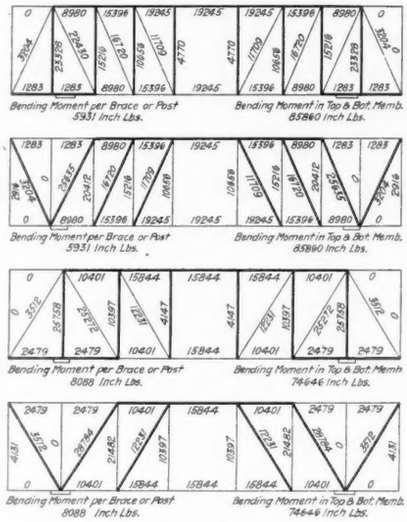


Fig. 16.

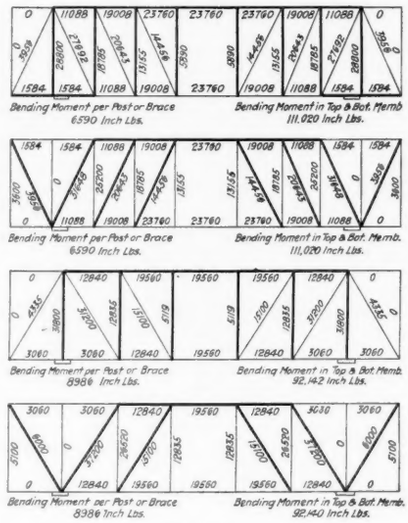


Fig. 17.

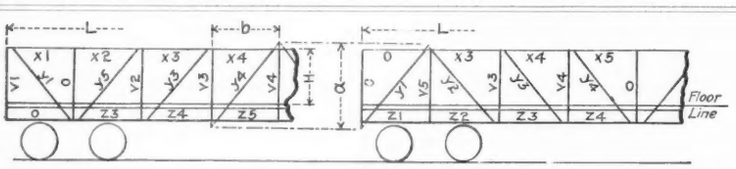


TABLE I.

FORCES IN STEEL SIDE TRUSS OF GONDOLA CARS OF 60,000 LBS. CAPACITY.

	L = 36 Feet.					L = 40 Feet.					L = 44 Feet.				
H=	3-0	3-6	4-0	4-6	5-0	3-0	3-6	4-0	4-6	5-0	3-0	3-6	4-0	4-6	5-0
A=	54	60	66	72	78	54	60	66	72	78	54	60	66	72	78
B=	54	54	54	54	54	60	60	60	60	60	66	66	66	66	66
X_1	2641	2300	2160	1981	1833	2935	2641	2392	2201	2031	3227	2904	2641	2420	2234
X_2	2641	2300	2160	1981	1833	2935	2641	2392	2201	2031	3227	2904	2641	2420	2234
X_3	13201	11880	10805	9900	9138	14688	13201	12000	11001	10155	16134	14521	13201	12100	11169
X_4	21120	19008	17280	15840	14622	23468	21120	19200	17600	16246	25812	23232	21120	19360	17871
X_5	23761	21384	19440	17821	16450	26416	23761	21612	19812	16525	29057	26151	23761	21793	20116
Z_1	2641	2300	2160	1981	1833	2935	2641	2392	2201	2031	3227	2904	2641	2420	2234
Z_2	2641	2300	2160	1981	1833	2935	2641	2392	2201	2031	3227	2904	2641	2420	2234
Z_3	13201	11880	10805	9900	9138	14668	13201	12000	11001	10155	16134	14521	13201	12100	11169
Z_4	21120	19008	17280	15840	14622	23468	21120	19200	17600	16246	25812	23232	21120	19360	17871
Z_5	23761	21384	19440	17821	16450	26416	23761	21612	19812	16525	29057	26151	23761	21793	20116
Y_1	3734	3568	3424	3309	3224	3920	3734	3568	3439	3330	4179	3930	3734	3583	3461
Y_2	18672	17519	17121	16542	16119	19644	18672	17839	17187	16647	20926	19644	18672	17911	17301
Y_3	11202	10702	10272	9925	9670	11786	11202	10702	10313	9988	12533	11986	11202	10747	10383
Y_4	3734	3568	3424	3309	3224	3930	3734	3568	3439	3330	4179	3930	3734	3583	3461
Y_5	22406	21087	20545	19851	19343	23574	22406	21407	20626	19977	25105	23574	22406	21494	20762
V_1	2641	2641	2641	2641	2641	2641	2641	2641	2641	2641	2641	2641	2641	2641	2641
V_2	13201	13201	13201	13201	13201	13201	13201	13201	13201	13201	13201	13201	13201	13201	13201
V_3	7919	7919	7919	7919	7919	7919	7919	7919	7919	7919	7919	7919	7919	7919	7919
V_4	5280	5280	5280	5280	5280	5280	5280	5280	5280	5280	5280	5280	5280	5280	5280
V_5	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000

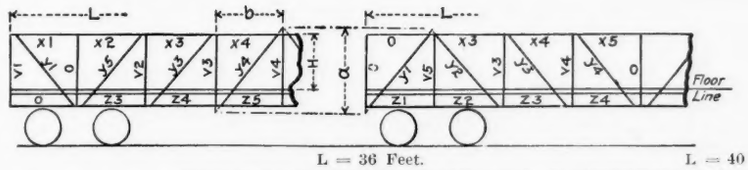


TABLE II.

FORCES IN STEEL SIDE TRUSS OF GONDOLA CARS OF 80,000 LBS. CAPACITY.

	L = 36 Feet.					L = 40 Feet.					L = 44 Feet.				
H=	3-0	3-6	4-0	4-6	5-0	3-0	3-6	4-0	4-6	5-0	3-0	3-6	4-0	4-6	5-0
A=	54	60	66	72	78	54	60	66	72	78	54	60	66	72	78
B=	54	54	54	54	54	60	60	60	60	60	66	66	66	66	66
X_1	3383	2968	2767	2537	2348	3759	3383	3064	2819	2602	4134	3721	3383	3100	2862
X_2	3383	2968	2767	2537	2348	3759	3383	3064	2819	2602	4134	3721	3383	3100	2862
X_3	16913	15221	13840	12684	11708	18792	16913	15375	14094	13010	20671	18604	16913	15503	14310
X_4	27060	24354	22140	20295	18734	30067	27060	24600	22550	20815	33071	29766	27060	24805	22897
X_5	30443	27398	24907	22832	21076	33844	30443	27690	25383	21250	37228	33505	30443	27921	25773
Z_1	3383	2968	2767	2537	2348	3759	3383	3064	2819	2602	4134	3721	3383	3100	2862
Z_2	3383	2968	2767	2537	2348	3759	3383	3064	2819	2602	4134	3721	3383	3100	2862
Z_3	16913	15221	13840	12684	11708	18792	16913	15375	14094	13010	20671	18604	16913	15503	14310
Z_4	27060	24354	22140	20295	18734	30067	27060	24600	22550	20815	33071	29766	27060	24805	22897
Z_5	30443	27398	24907	22832	21076	33844	30443	27690	25383	21250	37228	33505	30443	27921	25773
Y_1	4784	4571	4387	4239	4130	5034	4784	4571	4405	4266	5353	5034	4784	4590	4434
Y_2	23923	22695	21936	21194	20651	25168	23923	22855	22021	21328	26780	25168	23923	22948	22166
Y_3	14352	13712	13161	12716	12389	15100	14352	13712	13213	12797	16057	15200	14352	13769	13302
Y_4	4784	4571	4387	4239	4130	5034	4784	4571	4405	4266	5353	5034	4784	4590	4434
Y_5	28707	27266	26323	25433	24781	30202	28707	27426	26426	25594	32133	30202	28707	27538	26600
V_1	3383	3383	3383	3383	3383	3383	3383	3383	3383	3383	3383	3383	3383	3383	3383
V_2	16913	16913	16913	16913	16913	16913	16913	16913	16913	16913	16913	16913	16913	16913	16913
V_3	10147	10147	10147	10147	10147	10147	10147	10147	10147	10147	10147	10147	10147	10147	10147
V_4	6765	6765	6765	6765	6765	6765	6765	6765	6765	6765	6765	6765	6765	6765	6765
V_5	20375	20375	20375	20375	20375	20375	20375	20375	20375	20375	20375	20375	20375	20375	20375

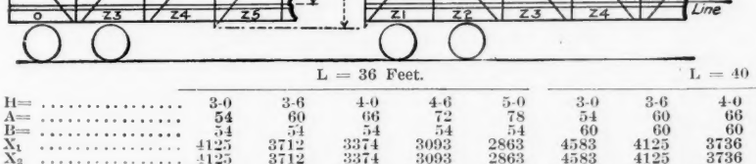


TABLE III.

FORCES IN STEEL SIDE TRUSS OF GONDOLA CARS OF 100,000 LBS. CAPACITY.

	L = 36 Feet.					L = 40 Feet.					L = 44 Feet.				
H=	3-0	3-6	4-0	4-6	5-0	3-0	3-6	4-0	4-6	5-0	3-0	3-6	4-0	4-6	5-0
A=	54	60	66	72	78	54	60	66	72	78	54	60	66	72	78
B=	54	54	54	54	54	60	60	60	60	60	66	66	66	66	66
X_1	4125	3712	3374	3093	2863	4583	4125	3736	3437	3173	5041	4537	4125	3780	3490
X_2	4125	3712	3374	3093	2863	4583	4125	3736	3437	3173	5041	4537	4125	3780	3490
X_3	20625	18562	16875	15468	14278	22916	20625	18750	17187	15865	25208	22687	20625	18906	17451
X_4	33000	29700	27000	24750	22846	36666	33000	30000	27500	25384	40330	36300	33000	30250	27923
X_5	37125	33412	30374	27843	25702	41272	37145	33768	30954	25975	45399	40859	37145	34049	31430
Z_1	4125	3712	3374	3093	2863	4583	4125	3736	3437	3173	5041	4537	4125	3780	3490
Z_2	4125	3712	3374	3093	2863	4583	4125	3736	3437	3173	5041	4537	4125	3780	3490
Z_3	20625	18562	16875	15468	14278	22916	20625	18750	17187	15865	25208	22687	20625	18906	17451
Z_4	33000	29700	27000	24750	22846	36666	33000	30000	27500	25384	40330	36300	33000	30250	27923
Z_5	37125	33412	30374	27843	25702	41272	37145	33768	30954	25975	45399	40859	37145	34049	31430
Y_1	5834	5574	5350	5169	5036	6138	5834	5574	5371	5202	6527	6138	5834	5597	5407
Y_2	29174	27871	26751	25846	25183	30692	29174	27871	26855	26009	32634	30692	29174	27985	27031
Y_3	17502	16722	16050	15507	15108	18414	17502	16722	16113	15606	19581	18414	17502	16791	16221
Y_4	5834	5574	5350	5169	5036	6138	5834	5574	5371	5202	6527	6138	5834	5597	5407
Y_5	35008	33445	32101	31015	30219	36830	35008	33445	32226	31211	39161	36830	35008	33582	32438
V_1	4125	4125	4125	4125	4125	4125	4125	4125	4125	4125	4125	4125	4125	4125	4125
V_2	20625	20625	20625	20625	20625	20625	20625	20625	20625	20625	20625	20625	20625	20625	20625
V_3	12375	12375	12375	12375	12375	12375	12375	12375	12375	12375	12375	12375	12375	12375	12375
V_4	8250	8250	8250	8250	8250	8250	8250	8250	8250	8250	8250	8250	8250	8250	8250
V_5	24750	24750	24750	24750	24750	24750	24750	24750	24750	24750	24750	24750	24750	24750	24750

the tendency of any load in bulk, such as grain, to bulge outward and also by the pressure of the load due to centrifugal force when the car is rounding a curve. The bending moment per post or brace due to the first cause is $M_1 = \frac{H^3 \tan^2\theta \ D \ W}{18 \times 1728}$ and the bending moment due to centrifugal force, assuming centrifugal force equal to four-tenths the load, is

$$M_2 = \frac{H^3 \ D \ W}{388{,}800}$$

The total bending moment in each post or brace at a point ⅓ H. from the floor is

$$M = H^3 \ D \ W \left(\frac{\tan^2\theta}{31{,}104} + \frac{1}{388{,}800} \right)$$

In the formulas

H = height of load in inches.

D = ½ distance between post in inches.

W = weight of lading in lbs. per cu. ft.

θ = ½ (90 deg. — angle of repose).

In calculating the bending moments shown on the diagrams, H was assumed to be 72 inches, W = 60 lbs. and θ = 30 deg.

Example: Design a 100,000-lb. capacity box car, M. C. B. standard inside dimensions, with steel framing, one intermediate post and diagonals in tension. To find the required sections for the principal members of the side truss.

The top chord or plate must resist a maximum stress of 19.560 lbs. near the center of the car. (See Fig. 17.) This requires at least 2.4 in. of effective cross-sectional area and for safety this might well be increased.

The bottom chord or side sill also carries 19,560 lbs. and should have quite as much, if not more, area than the side plate.

The bending moment in the top and bottom members is as high as 92,142 in.-lbs. and, assuming that the center sills are 12-in., 35-lbs. channels with a section modulus of 29.9, these sills will take care of the bending moment without exceeding a fiber stress of $\frac{92142}{29.9}$, or about 3,000 lbs. In order that the load at the middle of the car be transmitted from the sides to the center sills, the deep cross-bearers on each side of the cen-

TABLE VI.

BENDING MOMENTS IN INCH POUNDS IN STAKES AT FLOOR LINE.

D.	24 in. = H	26 in. = H	28 in. = H	30 in. = H	32 in. = H	34 in. = H	36 in. = H	38 in. = H	40 in. = H	42 in. = H	44 in. = H	46 in. = H	48 in. = H	50 in. = H	52 in. = H
24	1197	1523	1902	2339	2839	3405	4042	4754	5545	6419	7380	8433	9582	10830	12182
26	1297	1650	2060	2534	3075	3689	4379	5150	6007	6954	7995	9136	10380	11732	13197
28	1397	1777	2218	2728	3312	3973	4716	5546	6469	7489	8610	9839	11179	12635	14213
30	1497	1903	2377	2923	3548	4257	5053	5943	6931	8023	9225	10541	11977	13537	15228
32	1596	2030	2535	3118	3785	4540	5390	6339	7393	8559	9840	11244	12776	14440	16243
34	1696	2157	2693	3313	4022	4824	5727	6735	7855	9093	10455	11947	13574	15342	17258
36	1796	2284	2852	3508	4258	5108	6063	7131	8317	9628	11070	12650	14372	16245	18273
38	1896	2411	3011	3703	4495	5392	6400	7527	8779	10163	11685	13353	15171	17147	19289
40	1996	2538	3169	3898	4731	5675	6737	7923	9242	10698	12300	14055	15969	18050	20304
42	2095	2664	3328	4093	4968	5959	7074	8320	9704	11233	12915	14758	16768	18952	21319
44	2195	2791	3486	4288	5204	6243	7411	8716	10166	11768	13530	15461	17566	19855	22334
46	2295	2919	3644	4483	5441	6527	7748	9112	10628	12303	14145	16164	18365	20757	23349
48	2395	3046	3803	4678	5678	6810	8085	9508	11090	12837	14760	16866	19163	21660	24365
50	2495	3172	3962	4872	5914	7094	8421	9904	11552	13373	15375	17569	19962	22562	25380
52	2594	3299	4120	5067	6151	7378	8758	10300	12014	13908	15990	18272	20760	23465	26395

ter should be made very stiff and strong.

The maximum stress in the posts is 31,800, and it occurs over the bolster. The bending moment in the post is 8986 in.-lbs. A 3-in. Z-bar, 11.4 lbs. per ft. and having a section area of 3.36 sq. in., has a section modulus of 2.98. The compressive stress due to bending is $\frac{8986}{2.98} = 3{,}020$ lbs. and the compression due to the load is $\frac{31800}{2.98}$ or 9,464 lbs. These two forces combined give a total compressive force of 12,484 lbs. per sq. in., which exceeds the safe stress somewhat, but not sufficiently to require a heavier section at this place, since the combined stress will rarely be reached in practice.

The diagonal brace nearest the body bolster requires the same section, since the rivet holes must be considered. The other posts and braces can be made much lighter.

Gondola Cars with Sides Carrying the Load. These may be divided into two classes, those having a steel truss side with wooden planks and those having a plate-girder side.

The treatment of cars having steel-trussed sides is similar to that for box cars with trussed sides. The center sills are designed to resist end shocks only and the entire load is considered as being carried by the truss members of the side frame. The diagonals may be arranged for tension or compression, and in Tables I. to III. the forces are given for the different arrangements, panel spacing and depth of side for all three-capacity cars. The side sill is usually formed by an 8-in. channel, and to provide for this construction the intersection of the center lines of the posts and braces has been taken as 5 in. above the top of the side and 13 in. below the floor level. All panels are of uniform width and the load was considered as being distributed uniformly over the length of the car. A load of 110,000 lbs. was assumed for the 100,000-lb. car and 22,000 lbs. as the weight of the car body. For the 80,000-lb. and 60,000-lb cars, 82 per cent. and 64 per cent. of the forces found for the 100,000-lb. car were taken. The fiber stress in none of the members should exceed 12,500 lbs.

The calculation of the strength of the side girders for plate side frame construction is very simple. The bending moment at any section, x inches from the end sill with a uniformly distributed load is

$$M = \frac{Px}{2}\left(\frac{x}{l} - 1 + \frac{c}{x}\right).$$

To find the bending moment at the center of the car put $x = \frac{l}{2}$. The table below gives the combined bending moment in the center of the car due to load and weight of car body for different lengths of the three-capacity cars. The loads were taken as 110,000 lbs., 88,000 lbs. and 66,000 lbs., respectively, and the weights of the bodies as 24,000 lbs., 22,000 and 20,000 lbs.

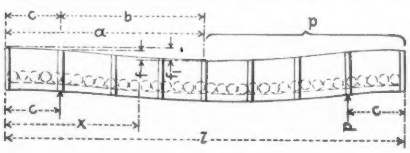


Fig. 18.

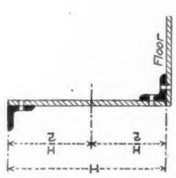
Table IV.—Moments in Center of Car.

Length Over End Sills.	Distance c. to c. Trucks.	60,000 Lb. Cars.	80,000 Lb. Cars.	100,000 Lb. Cars.
34 ft. ...	24 ft.	1,842,000	2,358,000	2,855,000
36 ft. ...	26 ft.	2,043,000	2,615,000	3,167,000
38 ft. ...	28 ft.	2,353,000	3,012,000	3,647,000
40 ft. ...	28 ft.	2,064,000	2,642,000	3,199,000
42 ft. ...	30 ft.	2,276,000	2,913,000	3,528,000
44 ft. ...	32 ft.	2,611,000	3,342,000	4,047,000
46 ft. ...	34 ft.	2,848,000	3,645,000	4,414,000
48 ft. ...	36 ft.	3,096,000	3,963,000	4,799,000

TABLE V.

MOMENT OF INERTIA I AND SECTION MODULUS Z FOR PLATE GIRDER GONDOLA CAR SIDES.

$e_c = \frac{H}{2}$ $e_t = \frac{H}{2}$



Top Angle.	H = 36 in. I.	H = 36 in. Z.	H = 38 in. I.	H = 38 in. Z.	H = 40 in. I.	H = 40 in. Z.	H = 42 in. I.	H = 42 in. Z.	H = 44 in. I.	H = 44 in. Z.
3 x 3 x 5/16	2016.6	112.0	2313.1	121.8	2635.7	131.7	2986.1	142.2	3363.9	152.8
3/8	2206.0	122.5	2525.5	132.9	2872.5	143.5	3248.4	154.7	3653.4	166.0
7/16	2393.2	132.9	2735.2	144.0	3105.9	155.2	3507.0	166.9	3938.3	178.9
1/2	2580.2	143.3	2944.8	155.0	3339.4	166.9	3765.5	179.3	4223.2	191.9
3½ x 3½ x 5/16	2180.0	121.1	2497.3	131.5	2841.9	142.0	3215.5	153.1	3617.9	164.4
3/8	2417.0	134.3	2763.0	145.4	3138.0	156.8	3543.5	168.7	3979.6	180.8
7/16	2622.8	145.7	2994.8	157.6	3396.5	169.7	3830.3	182.4	4296.1	195.2
1/2	2836.8	157.6	3234.7	170.2	3664.5	183.1	4127.9	196.5	4624.8	210.1
4 x 4 x 5/16	2339.5	129.9	2677.5	140.9	3044.2	152.1	3440.4	163.8	3867.4	175.7
3/8	1598.1	144.3	2967.6	156.2	3367.6	168.3	3799.4	180.9	4263.3	193.7
7/16	2849.4	158.3	3249.4	171.1	3682.4	184.0	4149.1	197.5	4649.6	211.3
1/2	3093.7	171.8	3524.2	185.5	3989.5	199.4	4489.5	213.8	5025.8	228.4

Top Angle.	H = 46 in. I.	H = 46 in. Z.	H = 48 in. I.	H = 48 in. Z.	H = 50 in. I.	H = 50 in. Z.	H = 52 in. I.	H = 52 in. Z.	H = 54 in. I.	H = 54 in. Z.
3 x 3 x 5/16	3771.2	163.9	4208.6	175.2	4676.9	187.1	5177.4	199.0	5711.0	211.5
3/8	4088.9	177.7	4555.8	189.8	5055.2	202.2	5587.9	214.8	6155.2	228.0
7/16	4401.5	191.3	4897.3	204.0	5426.9	217.1	5991.1	230.3	6591.2	244.1
1/2	4714.0	204.9	5238.8	218.3	5798.6	231.6	6394.3	245.8	7027.1	260.2
3½ x 3½ x 5/16	4050.9	176.0	4515.2	188.1	5011.8	200.5	5541.8	213.1	6106.1	226.1
3/8	4447.8	193.3	4949.0	206.2	5484.2	219.4	6054.3	232.8	6660.5	246.7
7/16	4795.6	208.4	5329.5	222.0	5899.5	236.0	6505.3	250.1	7148.6	264.8
1/2	5156.2	224.1	5724.3	238.5	6329.3	253.2	6972.3	268.1	7656.1	283.5
4 x 4 x 5/16	4325.5	188.0	4816.8	200.7	5341.1	213.7	5903.5	226.9	6495.5	240.6
3/8	4761.3	206.9	5293.2	220.5	5860.5	234.4	6464.2	248.5	7105.4	263.1
7/16	5185.5	225.4	5756.9	239.9	6366.3	254.7	7013.8	269.7	7700.6	285.2
1/2	5598.5	243.3	6209.2	258.7	6859.7	274.4	7549.3	290.3	8280.7	306.7

The Deflection of a plate girder side between the center of the car and the end (see Fig. 18) is

$$f_1 = \frac{p}{EI}\left(\frac{b^3}{3} + \frac{cb^2}{2} - \frac{a^3}{8}\right)$$

and the deflection measured between the center of the car and the bolster is

$$f = \frac{p}{EI}\left[\frac{b^3}{3} - \frac{a^3}{24}\left(\frac{c^4}{a^4} - \frac{4^c}{a} + 3\right)\right]$$

In the above equations

E = modulus of elasticity, usually 25,000,000.

I = moment of inertia.

p = load on one girder between the center and the end.

a = ½ length of car.

b = ½ distance between bolsters.

c = distance between end sill and bolster.

It will be found, usually, that the section modulus of the sides is so large that the fiber stresses are well below the safe working stress. The following table, Table V., shows the section modulus and moment of inertia for different depths of side and reinforcing angles. In calculating the values shown in the table, it was assumed that equal amounts of material were distributed in the top and bottom portions, so as to bring the neutral axis half way up. In most

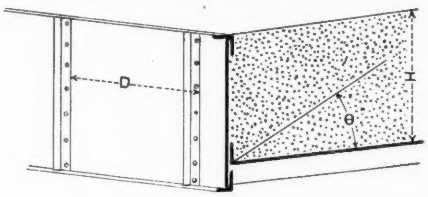


Fig. 19.

cases there is more material in the bottom portion, but the above method is justified because it simplifies the calculations and any additional material in the bottom portion can be considered as helping to resist the end shocks. To find the bending moment in the stakes at the floor line due to bulging of the load and centrifugal force, assuming

W = 57 lbs. per cu. ft. for coal.

H = depth of load, level with side of car.

D = distance between stakes.

θ = ½ (90 deg. — angle of repose) or 30 deg.

The moment due to bulging is

$$M_b = \frac{H^3\,D\,W\,\tan^2\theta}{6 \times 1728} \text{ or } .00185\,D\,H^3$$

The moment due to centrifugal force is

$$M_c = .00176\,D\,H^3$$

The combined moment is, therefore, $M = .00361\,D\,H^3$

The accompanying table, Table VI., gives the moments calculated by this formula for different values of H and D.

If the stakes themselves or the cross-beams under the floor are not strong enough to resist these moments, ties should be inserted across the car near the tops of the sides or else additional gusset sheets should be put in at the connections of the stakes to the cross-beams to keep the car body in shape.

The Austrian State railroads and most of the private railroads have agreed to offer the laborers in their employ the following reductions in fares: For those who have served their railroad uninterruptedly for three years, a reduction of 50 per cent. in the third class fare; for those five years in service, the rates of regular employees for themselves and a reduction of 50 per cent. in the third class fare for members of their families; for those who have served ten years, free passes for themselves and a reduction of 50 per cent. for members of their families.

History of the Railroad in the German Protectorate in China.*

It will be remembered that the German-Chinese Treaty of March, 1898, followed by the concession of June, 1899, provided for building a railroad in the province of Shan Tung. This railroad was planned to extend from Tsing Tow to Tsin Anfow, the capital of the province of Shan Tung. Branch lines were also provided for. The railroad system is to extend 800 miles in the shape of an equilateral triangle, which will surround the mountainous interior, while the railroad itself will run through partly hilly and partly flat country, densely populated and very fruitful. The population is almost exclusively agricultural, which fact would point to an important passenger and freight traffic in the future. The line also intersects several of the largest coal fields.

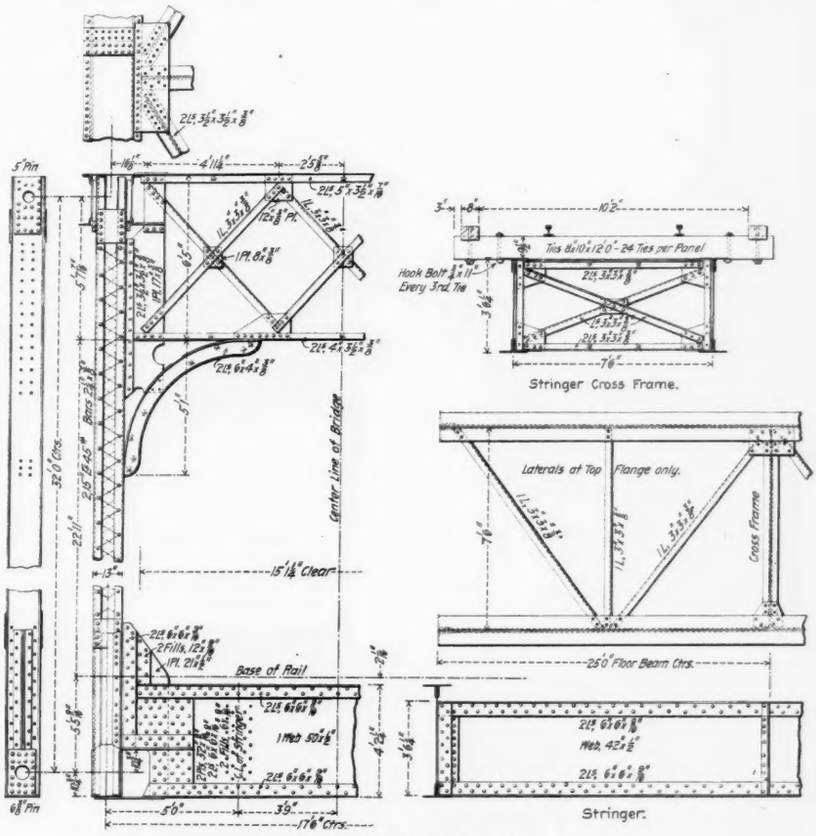
About 275 miles of the railroad are already complete and in operation. The difficulty of building it was largely the result of the inborn conservatism of the Chinese and their dislike of foreign interference. In acquiring the necessary land for the line, the familiar obstacle of the graves of their ancestors being disturbed had to be skilfully met. After a great deal of diplomacy proper compensation was fixed to the satisfaction of the bereaved Chinese. It turned out that the spirits offended by the coming of the foreign railroad had no more objections to raise as soon as any material advantage resulted from the railroad's presence; and ancestor worship yielded to the payment of a regular price per grave. The recent Boxer difficulties also constituted a serious hindrance to railroad building. Native workmen were largely employed, numbering at one time 25,000. The wages paid varied from 10 to 15 cents per day. Cement had to be brought from Europe, as well as the steel and iron used.

Beginning with April, 1901, successive sections of the railroad have been opened to the public. The management of the freight and passenger traffic seems to be skillful, and an increasing amount of business being done, though the difficulties to be contended with are very great. For instance, a system of agencies has had to be established as go-betweens between the railroad and the public. The province which the railroad traverses is half as large as the kingdom of Prussia, the size of its population twice as great. The railroad forms the only means of ready communication with the interior. Much is hoped from the prospective traffic in petroleum, cotton, iron and rice. Eventually the road is to be connected with the Chinese Railroad System constructed under British auspices.

*Condensed from the Journal of German Railroad Directors for June 1, 1904.

Kaw River Bridge of the Chicago Great Western and the Missouri Pacific.

The new bridge across the Kaw River at Kansas City for the joint use of the Chicago Great Western and the Missouri Pacific (Omaha line) was opened to traffic on May 24. This bridge replaces the old bridge of these two companies, which was wrecked in the flood of last year. The old structure was a combination wood and iron affair, with three spans of about 200 ft. each, resting on steel cylinder piers. The entire superstructure was destroyed and the channel piers were overturned. The new bridge occupies a site about 100 ft. north of the old one, there being two reasons for the change: Primarily the location was a better one in relation to the yards and terminals of the Great Western on both sides of the river, and, secondly, it avoided tearing out the abutments and other remains of the substructure of the old bridge. The new structure consists of three through pin-connected truss river spans 200 ft. long center to center of end pins, and a through plate-girder span at each end 80 ft. 1⅛ in. long, all on concrete piers. Piers 1 and 6, supporting the land ends of the girder spans, are steel cylinder piers on piling foundations, with concrete filling. The specifications required the piling to be driven to a depth of not less than 18 ft. below the bottom of the cylinder and to be cut off 16 ft. above the bottom. The sand inside the cylinders was required to be excavated so as to have a depth of not more



Details of Kaw River Bridge.

Kaw River Bridge, Chicago Great Western and Missouri Pacific, at Kansas City.

than 6 ft. above the bottom of the cylinder after the piles were driven.

In the original plans the foundations of piers 2 and 5 were to have been of the same design, namely, an open caisson with piles driven inside, and filled with concrete. But in sinking the caisson for No. 2, instead of the river silt which the soundings had indicated at that point, an old stone dyke 6 in. thick was encountered about 15 ft. below the surface of the water. Finding it impossible to get through this with the dredging apparatus on hand, the caisson was finally sunk to position by putting on a roof and employing the pneumatic process. The roof was then removed and the piles driven and concrete placed according to specifications. With pier 5, owing to difficulties encountered in sinking the open caisson and the shortness of the time remaining for the completion of the work, the contractor concluded to sink this

Portal View, Kaw River Bridge.

pier also with a pneumatic caisson and it was carried down to bed rock.

Channel piers 3 and 4 were sunk by pneumatic caissons to bed rock. During the sinking of No. 4 a corner of the caisson had to be cut through the iron span of an up-river bridge which was wrecked by the flood. The metal was encountered in the loose silt a few feet below the bottom of the river, in about 20 ft. of water, and considerable difficulty was experienced and time consumed in getting through.

The superstructure is designed for a load of two 154-ton consolidation engines followed by a train load of 4,000 lbs. per lin. ft. of track. However, parts of the floor system which are especially affected by concentrated loads have been made about 25 per cent. heavier than the above loading would require in order to provide for possible future increase in loading. Otherwise the design follows generally adopted lines in the working out of details, presenting no special features to which to direct attention. The elevation of base of rail is 2.3 ft. above the high-water mark of last year. The total weight of the superstructure is 1,673,000 lbs. The last truss was swung from the false work on March 24 and the first train crossed 60 days later.

The bridge was designed and built for the joint owners by the Chicago Great Western. The substructure was built by the Kahman-McMurray Company, Kansas City. The steel work was furnished by the Pennsylvania Steel Company, and was erected by the Missouri Valley Bridge & Iron Company, Leavenworth, Kan.

We are indebted to Mr. A. Munster, Acting Chief Engineer, for blueprints and information.

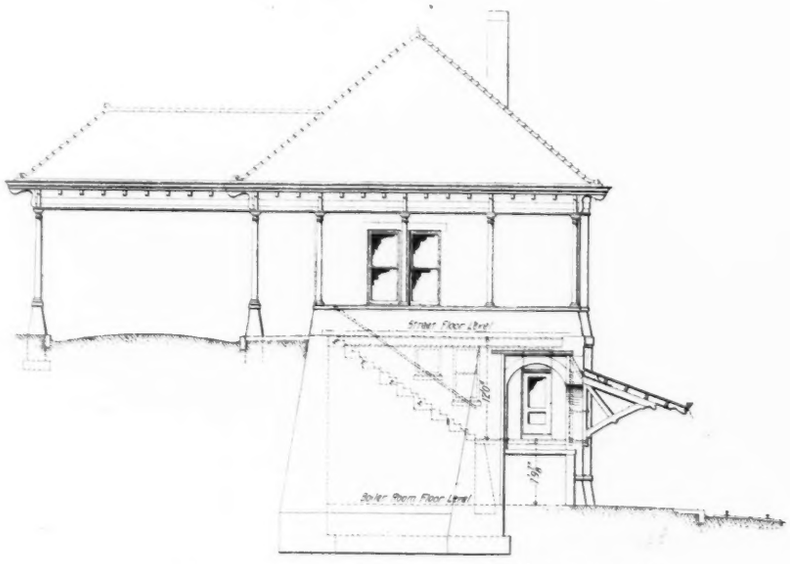
New Station of the Lackawanna at Roseville Avenue, Newark.

In the description of the D., L. & W. improvements and change of grade on the Morris & Essex Division through Newark, N. J., which was given in the *Railroad Gazette*, November 25, 1903, mention was made of the new station which was to be built at Roseville avenue, and one of the illustrations showed the concrete retaining walls of the excavation in which the station will stand. From High street, about a mile west of the new Broad street station, the tracks are depressed in a concrete walled cut with overhead street bridges, and this depression continues out to the city limits of Newark. At Roseville avenue, the double-tracked Montclair branch turns off to the north and the M. & E. division continues on west with three tracks, one being used for express trains. The old station, which was a frame building, stood on the street level in the apex of the angle formed by the main line and the Montclair branch. The new station building, however, will be located on the eastbound track of the Montclair branch, about 400 ft. from the junction and the train platform running in front of it extends down to the angle formed by the retaining walls of the cut and around the corner along the westbound track of the main line. There is no shelter over the westbound platform of the Montclair branch, but a large enclosed shelter house will be built for the eastbound platform of the main line. Two stairways from each of the three isolated platforms give access from and exit to the street.

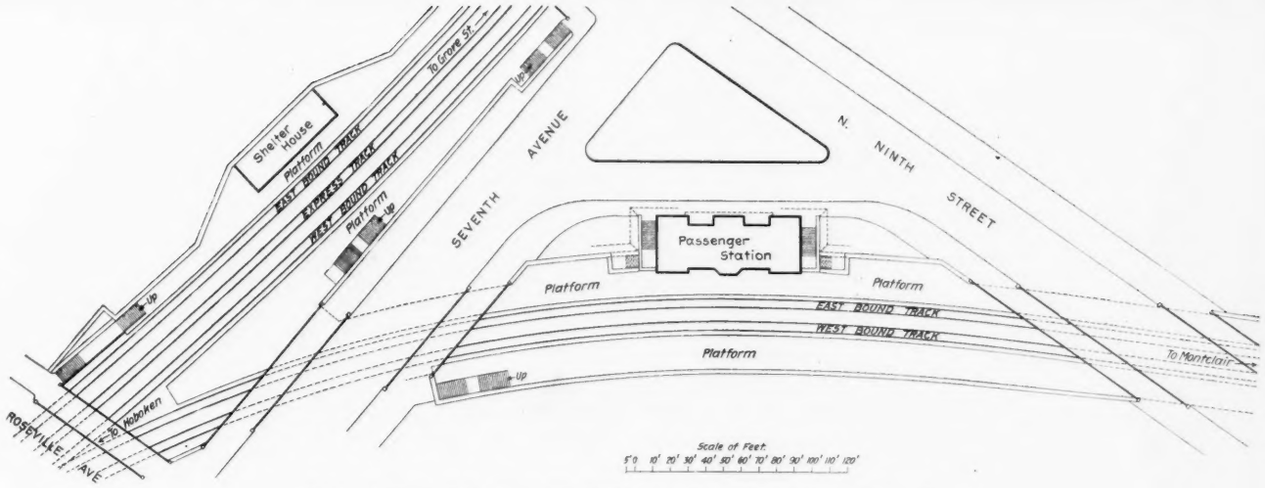
The station building, which is of brick, two stories high, is 103 ft. long and 30 ft. 6 in. wide. The platforms at the track level are 19 ft. below the surface of the street, and only one story of the building projects above ground. On the main floor, which is at the street level, are the main waiting room and ticket office, which occupy the center of the building, with the baggage room and ladies' waiting-room and toilet at either end. The entrance is from the plaza formed by Seventh avenue and North Ninth street, through three doors in the center of building. A covered portico shelters the entrance over the driveway and a canopy roof, supported on columns, extends around the three sides of the station. Broad covered stairways lead down to the train platforms at each end on the outside and two stairways lead down from the waiting-room on the street level to the other waiting-room on the lower floor. In the center of this room is the news stand, and leading off from the lower landing of one of the stairways is the men's waiting-room and toilet, which is located just below the ladies' room on the floor above. Under the baggage room is a storage room and shaft for the elevator which connects with the baggage room above. The back part of this lower floor is lighted and ventilated from two broad light wells or areaways built in the back wall. A canopy roof supported on brackets built in the wall of the building shelters the train platform in front of the station. Passengers taking trains either westbound on the Montclair branch or eastbound on the main line will purchase tickets in the waiting-room on the ground floor of the station and then walk over to the stairways leading down to these platforms from Seventh avenue and Roseville avenue.

Work on the retaining walls for the depressed tracks is nearly completed for their entire length, and the station is now in course of construction. It is expected to have the tracks in on the low level and the station ready for use before the end of this year.

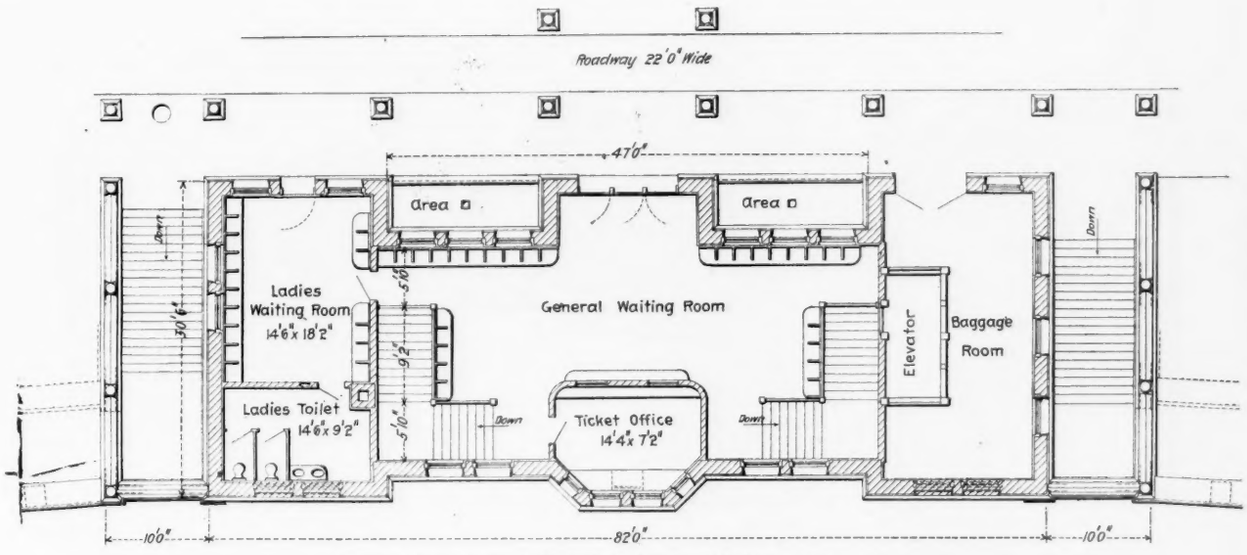
We are indebted to Mr. Lincoln Bush, Chief Engineer, for the drawings.



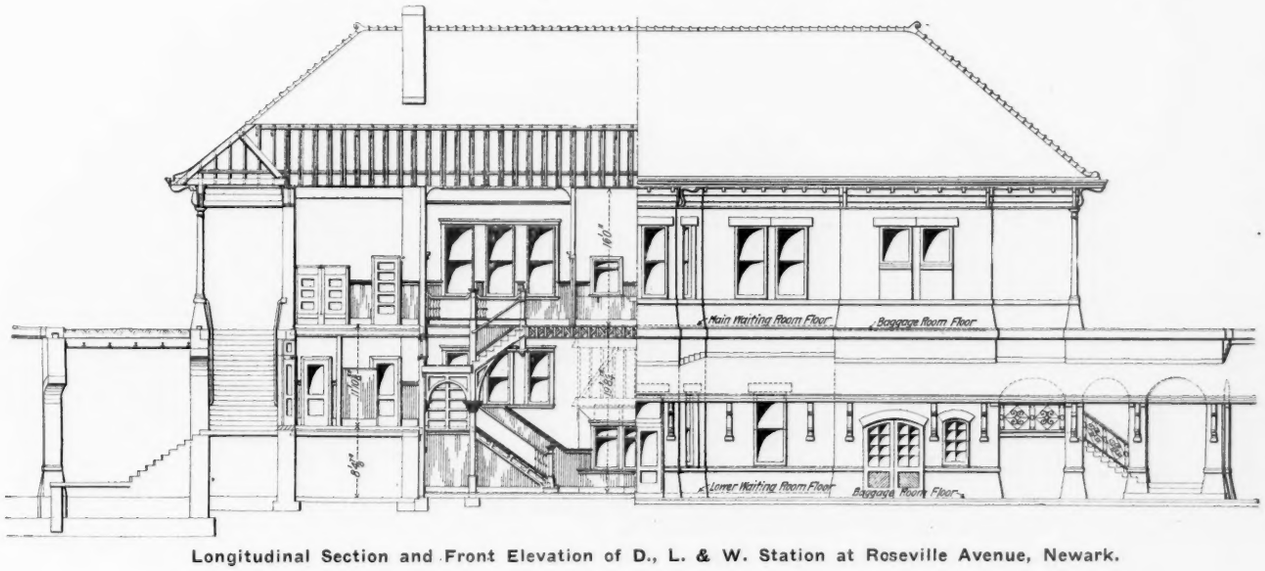
End Elevation of Roseville Avenue Station, at Newark.



General Plan of D., L. & W. Station at Roseville Avenue, Newark.



Street Floor Plan of Roseville Avenue Station—D., L. & W.



Longitudinal Section and Front Elevation of D., L. & W. Station at Roseville Avenue, Newark.

Railroad Shop Tools.

(*Continued.*)

BORING MILLS.

The 10-ft. boring and turning mill shown in Fig. 1 is made by the J. Morton Poole Company. This machine will take work 125 in. in diameter and 72 in. high under the cross rail and toolholders. The bed is cast in one piece and is braced with internal ribs. The uprights have a 14-in. face and are 11 ft. 2 in. high and are 50 in. deep at the bottom of the face. Each upright is secured to the bed by six 2-in. studs, and a stiff cross brace connects them at the top. The table is 96 in. in diameter by 8½ in. deep and is 30 in. above the floor; it has a flat annular bearing 4¾ in. wide at its extreme outer edge and is automatically lubricated. It has 24 table speeds in geometrical progression from four-tenths to twenty-four r.p.m., and is provided with 12 1¼-in. tee slots. The cone has three steps, 24, 22 and 20 in. in diameter for a 6-in. belt. Four rates of friction back gear are provided, giving ratios of 12, 36, 95 and 285 to 1; the back gears are in the bed and are protected from dirt and chips. Any back gear speed can be obtained without stopping the machine. Eight speeds in geometrical progression from ½ to 20 r.p.m. can be obtained. A Morse silent chain transmits the power from the cone pulley shaft or motor shaft to the back gear shaft.

The spindle is ground on dead centers and is bolted to the table; it rests on a step bearing at its lower end provided with taper wedge and adjusting screw for slightly elevating the table from its annular bearings when running at high speeds. The diameter of upper bearing is 18 in. and lower bearing is 14 in.; both are provided with adjustable boxes to take up wear and are supported in heavy bonnets bolted to the bed. Hindley worm gearing running in oil is used to drive the table; the worm wheel is 64 in. in diameter and the driving worm is 12 in. in diameter. Any adjustment or wear of the table bearing does not affect the alinement of the worm; the worm shaft is journaled in bronze bushings in the bed and the end thrust of the worm is taken by steel and bronze plates against a faced boss of the bed. Eight rates of horizontal, vertical or angular power feed in either direction can be obtained without stopping the mill, and independent feeds of 1/64 in., 1/32 in., 1/16 in., 1/12 in., ⅛ in., ¼ in., ½ in., and ⅔ in. per revolution of table are provided for each head. Feeds are reversed at the ends of the cross rail by means of friction hand wheels. Change gears for cutting thread are provided. Power traverse is provided for the cross heads and tool bars at a speed of 15 f.p.m. It is impossible to throw in the traverse and power feed at the same time. The usual hand wheels on cross heads for operating the tool bars are not required.

Belt driven mills have a pulley at the left side of the machine, which is driven at a constant speed from the countershaft. Motor-driven mills have a silent chain within the bed, which drives the traversing shaft from the back gear shaft. The cross rail is the box-girder form, 27½ in. high and 25 in. deep at the center and weighs complete 12,000 lbs. It is raised and lowered by power at a speed of 6⅔ f.p.m. The cross heads are made right and left, so that either head can be brought to the center for boring; they are entirely independent in their movements, both as to direction and amount of feed and can be set at any angle up to 45 deg. in either direction. The tool bars have a vertical feed of 42 in. Either head can

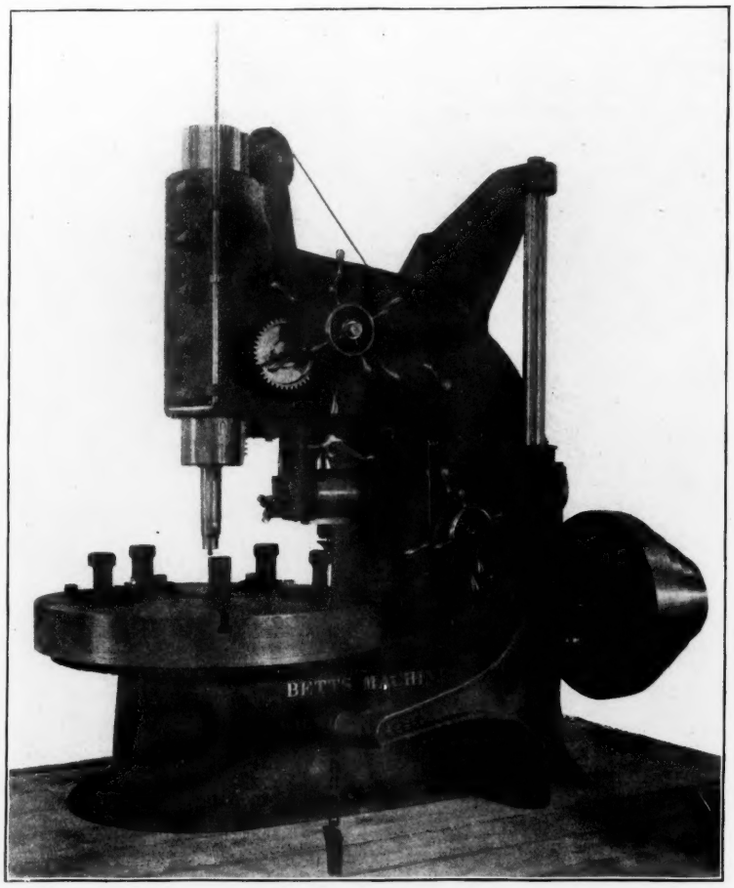


Fig. 4—The Betts 52-in. Car Wheel Boring Machine.

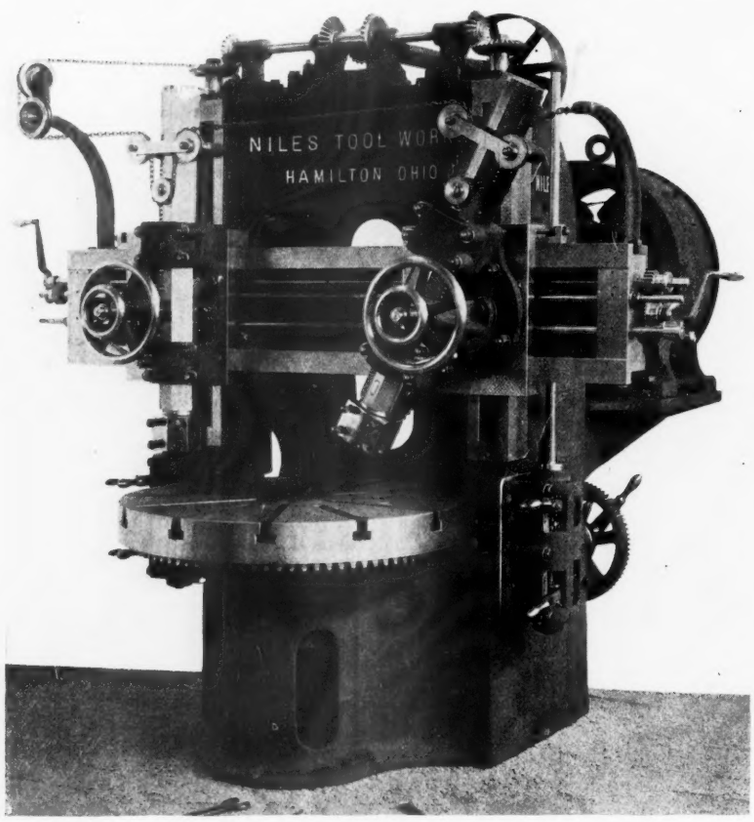


Fig. 1—The Poole 10-ft. Boring Mill.

be furnished with a revolving spindle. The countershaft has two friction pulleys 22 in. in diameter for a 6-in. belt and should run at 144 and 240 r.p.m. The floor space required for the machine is 10 ft. 6 in. x 16 ft. 3 in., and the net shipping weight is 63,000 lbs.

The illustration, Fig. 2, shows the general arrangement of the driving mechanism. The worm wheel has 96 teeth, 2.06 in. pitch and the outside diameter is 64 in. The steel driving worm has eight threads. Gears G and H, which are keyed to their shaft, drive the loose friction gears A and E. The driven chain gear T runs freely at the side of G and carries the pinion L, which drives the back gears U, S and R, the latter being loose on the shaft. The chain gear can drive the back gear shaft direct if the friction clutch between G and T is operated, or a back gear ratio of eight to one can be obtained by engaging the clutch O, which is keyed to the shaft, with the hub of gear R. These four back gear ratios and the two-speed countershaft give eight table speeds without shifting the cone belt. When the mill is motor driven the motor takes the place of the cone pulley and a speed reduction of 50 per cent. by any system of control gives the entire range of table speeds.

The 32-in. boring mill shown in Fig. 3 is made by the Rogers Machine Tool Company. This mill will take work 32 in. in diameter and 15½ in. high. The driving mechanism is fitted with a single pulley drive. The feeds are positive and all operating handles are convenient to the operator. Automatic trips are provided for the horizontal and vertical feeds. The head can be swiveled 30 deg. either way from the center. A five-hole turret is fitted to the tool stake. The adjustment and wear is taken up by means of taper gibs. The mills are usually fitted with a three-jaw chuck. A plain table or a four-jaw chuck is furnished when desired. The weight of this machine is 5,600 lbs.

The 52-in. car wheel boring mill made by the Betts Machine Company is shown in Fig. 4. The facing head of this machine is supported close to cut, and it is constructed so that it can be slid back entirely out of the way when chucking the wheels. The chuck is 52 in. in diameter; it has five jaws, which are universal and independent, and readily adjustable for wheels of any size from 42 in. diameter to 10 in. diameter, inclusive. Eight changes of speed are obtained by means of two speeds on the countershaft, arranged so that the change from boring to facing is done without moving the cone belt. The countershaft also has a powerful friction brake, enabling the operator to make rapid changes. The boring spindle has 25 in. travel, and is counterbalanced. The boring spindle and facing head are each provided with six automatic feeds, arranged so that the change from roughing to finishing can be made instantly, and without stopping the machine. A rapid hand movement is also provided for each. The facing head slide has a 7-in. travel and it is provided with a square guide. A power crane operated either by a belt or compressed air is attached to the machine. The weight of the machine is 17,000 lbs. All of the gears are cut from the solid.

(To be continued.)

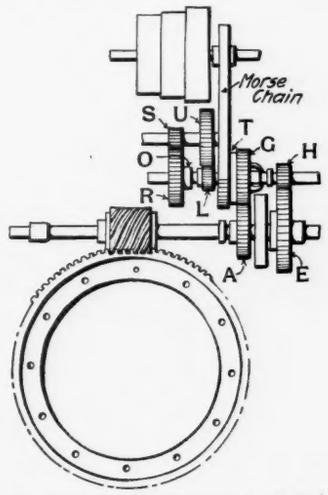


Fig. 2—General Arrangement of Driving Mechanism on the Poole Mill.

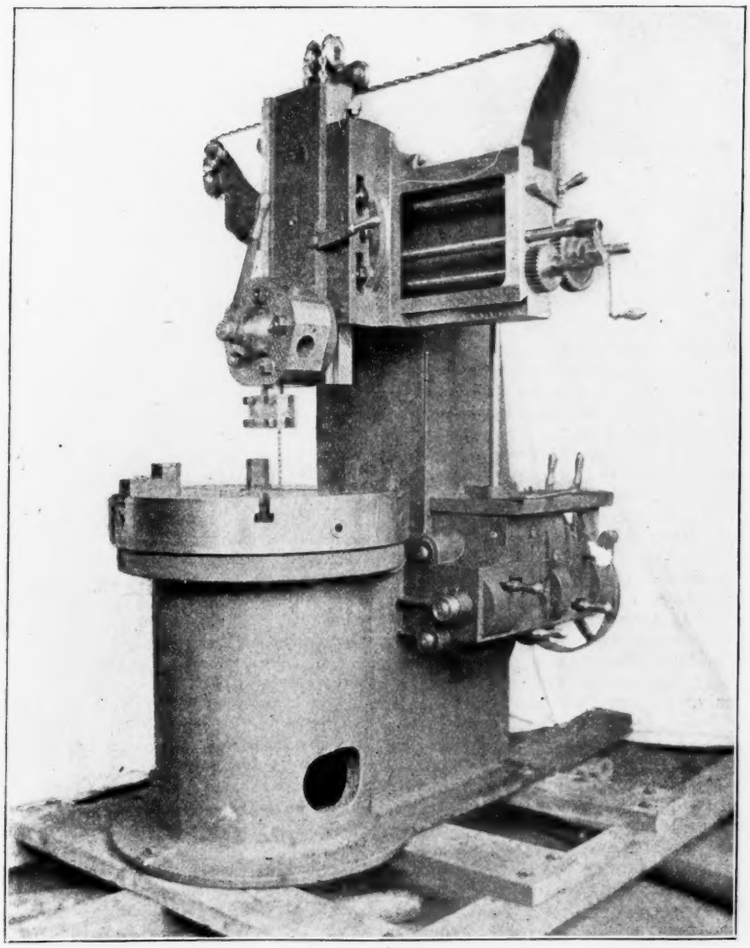


Fig. 3—The Rogers 32-in. Boring Mill.

Locomotive Tests of the Pennsylvania at St. Louis.

The first part of Bulletin No. 3 issued by the Pennsylvania was published in the *Railroad Gazette* last week. The remainder of the bulletin follows:

OBSERVED DATA.

196. Duration of test, hours.....

Speed.

197. Total revolutions .....
198. Average revolutions per minute.....
199. Equivalent speed in miles per hour.....
200. Equivalent piston speed in feet per minute...

Position of Levers.

201. Reverse lever, notches from front end.....
202. .....
203. Throttle lever .....
204. .....
205. .....

Temperature, Degrees Fahrenheit.

206. Of smoke-box, by thermometer.....
207. Of smoke-box, by pyrometer.....
208. Of laboratory, dry bulb.....
209. Of laboratory, wet bulb.....
210. Of steam in branch pipe.....
211. Of feed water.....
212. Of fire-box, by pyrometer.....
213. .....
214. .....
215. .....
216. .....

Pressure, Pounds per Square Inch.

217. In boiler, average .....
218. In boiler, maximum .....
219. In boiler, minimum .....
220. In branch pipe .....
221. In laboratory, barometric .....

Draft, Inches of Water.

222. In smoke-box, front of diaphragm.....
223. In smoke-box, back of diaphragm.....
224. In fire-box .....
225. In ash pan .....

Injectors.

Hours in action.

226. Total, right .....
227. Total, left .....

Quality of Steam.

228. In dome .....
229. In branch pipe .....
230. Degrees of superheat in branch pipe.....
231. .....

Coal, Sparks and Ash.

232. Coal fired, kind .....
233. Coal fired, total, pounds.....
234. Coal as fired, per cent. of moisture.....
235. Dry coal fired, total, pounds.....
236. Combustible, by analysis, total, pounds.....
237. Ash, by analysis, total, pounds.....
238. Cinders collected in smoke-box, total, pounds.
239. Sparks discharged from stack, total, pounds.
240. Cinders and sparks, total, pounds.....

Analysis of Coal.

241. Fixed carbon, per cent.....
242. Volatile matter, per cent.....
243. Moisture, per cent.....
244. Ash, per cent.....
245. Sulphur determined separately, per cent.....
246. .....
247. .....

Calorific Value in B. T. U., per lb.

248. Of dry coal .....
249. Of combustible .....
250. Of cinders and sparks.....
251. .....
252. .....

Analysis of Smoke-Box Gases.

253. Oxygen—O, per cent.....
254. Carbon monoxide—CO, per cent.....
255. Carbon dioxide—CO_2, per cent.....
256. Nitrogen—N, per cent.....
257. .....
258. .....

Water, in Pounds.

259. Delivered to injectors.....
260. Lost, from boiler .....
261. Lost, from .....
262. Lost, from .....
263. Lost, total .....
264. Delivered to boiler and presumably evaporated

Dynamometer.

Pull in pounds.

265. Average .....
266. Maximum .....
267. Minimum .....

Cut-off, Per Cent. of Stroke.

268. High pressure cylinder, right, head end.....
269. High pressure cylinder, right, crank end....
270. High pressure cylinder, left, head end.....
271. High pressure cylinder, left, crank end.....
272. Low pressure cylinder, right, head end.....
273. Low pressure cylinder, right, crank end.....
274. Low pressure cylinder, left, head end.....
275. Low pressure cylinder, left, crank end.....

Release, per Cent. of Stroke.

276. High pressure cylinder, right, head end.....
277. High pressure cylinder, right, crank end....
278. High pressure cylinder, left, head end.....
279. High pressure cylinder, left, crank end.....
280. Low pressure cylinder, right head end.....
281. Low pressure cylinder, right, crank end.....
282. Low pressure cylinder, left, head end.....
283. Low pressure cylinder, left, crank end.....

Beginning of Compression, Per Cent. of Stroke.

284. High pressure cylinder, right, head end.....
285. High pressure cylinder, right, crank end....
286. High pressure cylinder, left, head end.....
287. High pressure cylinder, left, crank end.....
288. Low pressure cylinder, right, head end.....
289. Low pressure cylinder, right, crank end.....
290. Low pressure cylinder, left, head end.....
291. Low pressure cylinder, left, crank end.....

Pressure from Indicator Cards.

Initial pressures, pounds per sq. inch.

292. High pressure cylinder, right, head end.....
293. High pressure cylinder, right, crank end....
294. High pressure cylinder, left, head end.....
295. High pressure cylinder left, crank end.....
296. Low pressure cylinder, right, head end.....
297. Low pressure cylinder, right, crank end.....
298. Low pressure cylinder, left, head end.....
299. Low pressure cylinder, left, crank end.....
300. .....

Steam Chest Pressures, Pounds per Sq. In.

301. High pressure, right side.....
302. High pressure, left side.....
303. Low pressure, right side.....
304. Low pressure, left side.....
305. .....

Pressures at Cut-off, Pounds per Sq. Inch.

306. High pressure cylinder, right, head end.....
307. High pressure cylinder, right, crank end....
308. High pressure cylinder, left, head end.....
309. High pressure cylinder, left, crank end.....
310. Low pressure cylinder, right, head end.....
311. Low pressure cylinder, right, crank end....
312. Low pressure cylinder, left, head end.....
313. Low pressure cylinder, left, crank end.....

Pressures at Release, Pounds per Sq. In.

314. High pressure cylinder, right, head end.....
315. High pressure cylinder, right, crank end....
316. High pressure cylinder, left, head end.....
317. High pressure cylinder, left, crank end.....
318. Low pressure cylinder, right, head end.....
319. Low pressure cylinder, right, crank end....
320. Low pressure cylinder, left, head end.....
321. Low pressure cylinder, left, crank end.....

Pressures at Beginning of Compression, Pounds per Sq. Inch.

322. High pressure cylinder, right, head end.....
323. High pressure cylinder, right, crank end.....
324. High pressure cylinder, left, head end.....
325. High pressure cylinder, left, crank end.....
326. Low pressure cylinder, right, head end.....
327. Low pressure cylinder, right, crank end.....
328. Low pressure cylinder, left, head end.....
329. Low pressure cylinder, left, crank end.....

Least Back Pressure, Pounds per Sq. Inch.

330. High pressure cylinder, right, head end.....
331. High pressure cylinder, right, crank end....
332. High pressure cylinder, left, head end.....
333. High pressure cylinder, left, crank end.....
334. Low pressure cylinder, right, head end.....
335. Low pressure cylinder, right, crank end.....
336. Low pressure cylinder, left, head end.....
337. Low pressure cylinder, left, crank end.....

SUMMARY OF AVERAGE RESULTS.

Boiler.

338. Dry coal fired, per hour, pounds.....
339. Dry coal fired, per hour, per sq. ft. of grate surface, pounds .....

Evaporation, Pounds.

340. Moist steam per hour.....
341. Dry steam per hour.....
342. Dry steam per hour, per sq. ft. of heating surface .....
343. Dry steam per hour, per pound of dry coal..

Equivalent Evaporation from and at 212 Degrees F.

344. Per hour, pounds .....
345. Per hour, per sq. ft. of heating surface, pounds .....
346. Per pound of coal as fired, pounds.....
347. Per pound of dry coal, pounds.....
348. Per pound of combustible, pounds.....
349. Boiler horse power .....
350. Efficiency of boiler.....

SUMMARY OF AVERAGE RESULTS—ENGINE.

Mean Effective Pressure, Pounds per Sq. Inch.

351. High pressure cylinder, right, head end.....
352. High pressure cylinder, right crank end.....
353. High pressure cylinder, left, head end.....
354. High pressure cylinder, left, crank end.....
355. Low pressure cylinder, right, head end.....
356. Low pressure cylinder, right, crank end.....
357. Low pressure cylinder, left, head end.....
358. Low pressure cylinder, left, crank end.....

Receiver.

359. Pressure, right side .....
360. Pressure, left side .....

Number of Expansions.

361. Right side, head end.....
362. Right side, crank end.....
363. Left side, head end.....
364. Left side, crank end.....

Indicated Horse Power.

365. High pressure cylinder, right, head end.....
366. High pressure cylinder, right, crank end....
367. High pressure cylinder, left, head end.....
368. High pressure cylinder, left, crank end.....
369. Low pressure cylinder, right, head end.....
370. Low pressure cylinder, right, crank end.....
371. Low pressure cylinder, left, head end.....
372. Low pressure cylinder, left, crank end.....

Division of Power.

373. High pressure cylinder, right side.....
374. High pressure cylinder, left side.....
375. Low pressure cylinder, right side.....
376. Low pressure cylinder, left side.....
377. Right side, total .....
378. Left side, total .....
379. Total .....

Per I. H. P. per Hour.

380. Dry coal, pounds .....
381. Dry steam, pounds.....
382. B. T. U. .....

SUMMARY OF AVERAGE RESULTS—LOCOMOTIVE.

383. Dynamometer horsepower.
384. Dry coal per D. H. P. per hour, pounds.....
385. Dry steam per D. H. P. per hour, pounds....
386. B. T. U. per D. H. P. per hour, pounds.....

Per One Million Foot Pounds at Drawbar.

387. Dry coal, pounds .....
388. Dry steam, pounds .....
389. B. T. U. .....
390. I. H. P. per square foot of heating surface..
391. I. H. P. per square foot of grate surface....
392. D. H. P. per square foot of heating surface..
393. D. H. P. per square foot of grate surface....
394. Tractive Power based on M. E. P., pounds..

Machine Friction of Locomotive in Terms of.

395. Horse power .....
396. M. E. P., pounds.....
397. Drawbar pull, pounds.....

Efficiency.

398. Machine efficiency of locomotive, per cent...
399. Efficiency of locomotive, per cent.....

Ratios.

400. Total weight of locomotive to maximum I. H. P.....
401. Total heating surface to maximum I. H. P...
402. .....
403. .....
404. .....
405. .....
406. .....
407. .....

SUMMARIZED STATEMENT OF AVERAGE RESULTS.

196. Duration of test hours.....
198. Number of revolutions per minute.....
199. Speed in miles per hour.....
268 to 271. Approximate cut-off in high pressure cylinder, in per cent. of stroke.....
203. Position of throttle.....
217. Boiler pressure in pounds per sq. in.....
220. Branch pipe pressure in pounds per sq. in...
222. Draft in front of diaphragm, inches of water
338. Dry coal fired per hour, pounds.....
341. Dry steam used per hour, pounds.....
344. Equivalent number of pounds of water from and at 212 deg. F. per pound of dry coal..
379. Indicated horse power .....
383. Dynamometer horse power .....
395. Frictional horse power .....
265. Drawbar pull, pounds.....
380. Dry coal per I. H. P. per hour, pounds.....
384. Dry coal per D. H. P. per hour, pounds.....
381. Dry steam per I. H. P. per hour, pounds....
385. Dry steam per D. H. P. per hour, pounds....
350. Efficiency of boiler .....
399. Efficiency of locomotive.....

OBSERVED DATA.

All instruments will be read at intervals of ten minutes during the test. Observations of the more important facts will be taken by two methods, and all calculations will be carefully checked.

Item No. 196. The locomotive will be gradually brought to the required conditions of speed and drawbar pull, and after it has been running under these conditions for a sufficient time to secure uniformity in the rate of firing and to allow all parts to come to their normal working condition, the test will be started.

The heavy power tests will continue until 30 lbs. of water have been evaporated per sq. ft. of heating surface, the lighter power test being stopped at the end of four to **six hours.**

The duration of test, given in hours and decimals of an hour, is the elapsed time from the start as given above to the close of test.

Item No. 197. A return crank, attached to the rear pair of drivers, is connected to a rotating revolution counter, which will be read at the beginning and end of test, and every ten minutes as well. A reciprocating revolution counter is connected with the corresponding supporting axle. From the diameters of the driving wheel and supporting wheel, a factor will be obtained by which the number of revolutions shown on supporting wheel counter can be compared with the number shown by driving wheel counter.

A tachometer will also be driven by the supporting axle, and this will provide a check for the average revolutions.

Item No. 206. For the smoke-box temperature a thermometer with carbon dioxide above the mercury will be used as a check on the indications of the pyrometer.

Items Nos. 207 and 212. Le Chatelier couples and a galvanometer reading to millivolts, will give the smoke-box and fire-box temperatures.

The couple in the smoke-box will remain in position; the couple in the fire-box will be inserted through an opening in the side, about midway of its length, and at a height above the bed of coal of about 12 in. After it has been in position with the fire door closed a sufficient time to assume the temperature of the fire-box, readings will be taken and the couple withdrawn from fire-box.

Item No. 210. The temperature of the steam in branch pipe will be calculated from the observed pressure of steam in same and from the observed pressure and temperature of the steam in the calorimeter connected to the branch pipe.

Item No. 211. The feed water temperature will be taken in the receiving tank.

Items Nos. 217, 218, 219 and 220. Steam pressures will be obtained by special test gages; the gage for indicating boiler pressure will be located on the steam dome on the calorimeter pipe connection, and the gage for branch pipe outside of smoke front, connected to branch pipe by as short a pipe as possible. The pressure gage located in pipe from boiler or branch pipe and leading to throttling calorimeter will be read (after the other calorimeter readings have been taken) with the valve between boiler or branch pipe and calorimeter closed on account of the drop in pressure in the pipe leading to the calorimeter while that valve is open.

Item No. 221. The barometric pressure will be measured by use of a mercurial barometer, readings being corrected for temperature, and readings in inches of mercury converted into pounds per square inch.

Items Nos. 222 to 225. The draft will be measured by "U" tube draft gages, the readings of which will be checked by recording draft gages of an approved type.

Items Nos. 228, 229 and 230. The quality of steam in dome and branch pipe will be obtained by Peabody throttling calorimeters, provided with mercurial gages reading to tenths of pounds, and thermometers reading to half degrees.

The quality of steam, and degrees of superheat, for the throttling-calorimeter, will be calculated as follows:

Let x = the "quality of the steam" or the number of pounds of "dry" ("saturated") steam of the same boiler pressure per square inch and containing the same quantity of heat as one pound of steam under test. x therefore may be greater or less than unity according as the steam is superheated or moist and equal unity when that steam is dry or saturated.

λ = Total heat of dry steam due to the absolute boiler pressure.

r = Latent heat of dry steam due to the absolute boiler pressure.

q = Heat of the liquid due to the absolute boiler pressure.

$r + q = \lambda$.

λ_1 = The "total heat" of dry steam due to the absolute pressure in the calorimeter.

t_1 = The temperature due to saturated steam at calorimeter pressure.

t_s = The temperature of the steam in the calorimeter in any case.

t_{s_0} = The temperature of the steam in

the calorimeter in case the steam in the boiler is dry.

k° = The number of degrees of superheat in case of superheated steam.

The following formula is then derived on the assumption that no heat is lost by the steam in its passage from the boiler to the calorimeter, and that 0.48 is the "specific heat" of steam.

$$xr + q = \lambda_1 + .48\,(t_s - t_1)$$

consequently, the quality of steam, Items Nos. 228 and 229, is

$$x = \frac{\lambda_1 + .48\,(t_s - t_1) - q}{r} \quad \ldots\ldots\ldots (1)$$

The steam under test is dry (saturated) when $x = 1$ and in that case, t_s becoming t_{so} as defined above,

$$t_{so} = \frac{(r + q) - \lambda_1 + .48\,t_1}{.48} = \frac{\lambda - \lambda_1 + .48\,t_1}{.48};$$

so that when the temperature t_s in the calorimeter is higher than t_{so} or that due to dry steam, the steam is superheated and the number of degrees of superheat, Item No. 230, will be $t_s - t_{so} = k^\circ$

$$k^\circ = t_s - \frac{\lambda - \lambda_1 + .48\,t_1}{.48} = \frac{\lambda_1 + .48\,(t_s - t_1) - \lambda}{.48}$$

$$= \frac{(x - 1)\,r}{.48} \quad \ldots\ldots\ldots\ldots (2)$$

When the temperature in the calorimeter is less than t_{so}, the priming is $(1-x)$, x being found as per formula above given. If, however, t_s drops to t_1 the limit of the calorimeter is reached and $x = x_o = \frac{\lambda_1 - q}{r}$ at most, and the priming $(1 - x_o) = 1 - \frac{\lambda_1 - q}{r} = \frac{\lambda - \lambda_1}{r}$ at least.

Therefore, for any case where t_1 is equal to t_s, the priming is equal to or greater than the capacity of the calorimeter, and to determine such greater amount of priming, Carpenter's separating calorimeter, also attached to the dome on the same connection will be used whenever the temperature in the calorimeter falls close to, or to within, say, 5° of the limit referred to.

In this case, the quality x is determined as described by Carpenter in his "Text Book of Experimental Engineering," or as follows:

Let w = Weight of dry steam discharged at the exhaust orifice of the calorimeter, the amount being known from calibration to agree very approximately with Napier's Rule, namely, "The flow in pounds per second" = $^1/_{70}$ part of the product obtained by multiplying the pounds per square inch absolute pressure in calorimeter by the area of the orifice in square inches.

W = Weight of the water drawn from the separator of the calorimeter.

R = Weight of the water of condensation in the calorimeter, due to radiation from the same.

And if we now call W_1 the portion of W left after deducting the radiation, the weight of dry steam that would have been discharged had there been no radiation, is $w + R$ and the total steam and water delivered to the calorimeter is

$$(W_1 + R) + w = W + w, \quad \text{so that}$$

$$x = \frac{w + R}{W_1 + R + w} = \frac{w + R}{W + w}$$

If the radiation is neglected, $x = \frac{w}{W + w}$ (3)

which with the instrument provided will be considered correct, as the radiation loss is very small.

The "quality of steam" being thus determined, the "correction for quality of steam" is found as follows:

Let F = "The factor of correction for quality of steam" desired.

Let x, λ, r and q stand for the same quantities as in the above formula for the quality of the steam.

q_1 = "Heat of the liquid" due to the feed water, the temperature of which will be observed.

Then the amount of heat actually added to each pound of feed water, making steam of quality x, is

$$x\lambda + (1 - x)\,q - q_1 \text{ or } x\,(\lambda - q_1) + (1 - x)\,(q - q_1)$$

and $(\lambda - q_1)$ is the amount of heat that would have been required by each pound of the same feed water to make dry steam at same pressure.

Consequently, the amount of dry steam equivalent to one pound of the actual mixture (*i. e.*, the amount of dry steam requiring for its generation the same supply of heat as that actually supplied to each pound of feed water) is

$$F = \frac{\lambda + x\,(1 - x)\,q - q_1}{\lambda - q_1} =$$

$$\frac{x\,(\lambda - q_1) + (1 - x)\,(q - q_1)}{\lambda - q_1} =$$

$$x + (1 - x)\,\frac{q - q_1}{\lambda - q_1} \quad \ldots\ldots\ldots (4)$$

Formula (3) is the general one for F and may be used in any case but when the steam is superheated, x is greater than unity, consequently more convenient will be

$$F = x - (x - 1)\,\frac{q - q_1}{\lambda - q_1} \quad \ldots\ldots\ldots (4a)$$

and as the degrees of superheat are known from the formula (2) for degrees of superheat, the simpler formula

$$F = 1 + \frac{48\,k^\circ}{\lambda - q_1} \quad \ldots\ldots\ldots (4b)$$

may be used, that is, of the formulæ (4), (4a), and (4b) each one gives the same value for "the factor F of correction for quality of steam."

In case observations are made of the actual temperature T and of the pressure p of the superheated steam itself, the degrees of superheat will be more directly obtained by subtracting from this T the t given in Peabody's steam tables corresponding to the pressure p. The value of F in that case is also more directly obtained from

$$F = \frac{(\lambda - q_1) + .48k^\circ}{\lambda - q_1} = 1 + \frac{.48k^\circ}{\lambda - q_1} \quad \ldots (5)$$

as already given.

Item No. 232. All coal used will be furnished by one mine throughout the entire period of the tests, precautions being taken to have it as uniform as possible.

Items Nos. 233 and 234. The coal will be brought to the testing plant loaded in boxes containing approximately 1,000 lbs. These boxes will be moved by the traveling crane, as needed, to a calibrated platform scale, weighed, and the coal box moved to firing platform and the coal dumped. After dumping and before sprinkling, if this is necessary, a small sample will be taken and placed in a covered box, so located that the coal contained will not be exposed to heat. The empty box will then be weighed on the platform scale, and the difference of the gross and tare weights so obtained will give the coal used; the amount set aside as sample being subtracted from the actual total coal charged to the boiler. The amount of water used in sprinkling coal will be noted and correction made if necessary.

The coal taken as a sample will be crushed to the size of an almond, and reduced, by quartering, to about 15 lbs. weight. The latter will be weighed on an accurate balance, and dried by an electric heater until loss of weight ceases; the loss in weight will be considered as the moisture contained in the coal as fired.

Item No. 235. The total dry coal fired will be obtained by deducting from the total coal fired the weight of moisture.

Items Nos. 236 and 237. Both of these quantities will be found by analysis, because the draft in a locomotive fire-box is so great as to draw a part of the ashes through the flues and give incorrect data if actual weights were taken. If the ash is found by analysis, the combustible must necessarily be obtained in the same manner.

Item No. 238. The smoke-box front will be cleaned at the beginning of test and at close, and the quantity of cinders which have collected during the test will be weighed by an accurate scale.

Item No. 239. The stack, by which the smoke will be removed from the building, is provided with a deflector and a receptacle into which the sparks which strike the deflector will fall. This receptacle will be cleaned at commencement of test and at close, the sparks which have been collected during the test being carefully weighed.

Items Nos. 241 to 246. The analysis of the coal will be made in accordance with the method decided on by the Committee of the American Chemical Society, and given in Volume 21, No. 12, of their Journal.

Items Nos. 248 to 250. The calorific value of the coal and cinders and sparks will be determined in the Thompson calorimeter.

Items Nos. 253 to 256. The analysis of smoke-box gases will be conducted by the use of the Orsat apparatus.

Item No. 259. The water used by the boiler will pass through two calibrated water meters to two steel measuring tanks holding about 1,500 lbs. of water each; and from thence to a receiving tank holding about 17,000 lbs. of water.

The measuring tanks rest on calibrated platform scales, so that their capacities can be calibrated at frequent intervals, correction being made for temperature.

To obtain the total water delivered to injectors, the number of times each tank is emptied will be multiplied by their calibrated capacities at the average temperature of water during the test, and the fractional part of tank weighed out at close, added.

At the beginning of test the level of water in the boiler and receiving tank will be noted; the levels of water in both will be kept slightly below these levels during the test. At the close sufficient water will be fed into the receiving tank to restore the initial level. The level in the boiler will be noted, and when not the same as at the start, a correction will be made.

The quantities found by the measuring tanks are checked by two meters. Provision being made to catch and measure the small amount of water wasted in filling the tanks, the meter readings less this waste will be a check on the quantity delivered by the measuring tanks.

Items Nos. 260 to 263. The water which escapes from the injector overflow pipes will be caught and returned to receiving tank; and no credit will be given the boiler for the rise in temperature, if any, of this water.

Great care will be taken to prevent leakage from the boiler; the air pump and steam heat throttles will be disconnected so that leakage may be detected and the throttles made tight.

Leakage tests, when necessary, will be made on boiler after close of test, due allowance being made for change of temperature of water.

Item No. 265. The pull exerted by the locomotive will be measured by a traction dynamometer, already described in Bulletin No. 2.

The pen on the dynamometer will give a

continuous record of the drawbar pull, which will be measured at ten-minute intervals; the average of these measurements to the scale of springs used will give the average drawbar pull.

An integrating attachment records the square inches of the area included between the line of zero pull, or the base line, and the line of drawbar pull; this area, divided by the length of diagram will give the average height and provides a check for the mean height obtained in the method first described.

Items Nos. 266 and 267. The maximum and minimum drawbar pull will be found by measuring the diagram after the test, or will be registered by an automatic attachment.

Items Nos. 268 to 291. The percentages of stroke, at which cut-off, release, and beginning of compression take place, will be determined by locating on each card the points at which these events occur. This will be done by the same method throughout the entire series of tests.

The length of each indicator card will be measured and an average obtained for cards for each end of each cylinder; the length of stroke up to the time cut-off takes place will be measured and averaged in a similar manner. The percentage that this average length of cut-off forms of the average length of card, will be the result on the data sheet. The percentage of stroke at which the other events mentioned take place will be calculated in a similar manner.

Items Nos. 292 to 299 and 306 to 329. The points showing the events of the stroke on indicator card at which pressures are measured, are described in the preceding paragraph, with the exception of the point representing the initial pressure, which also will be measured.

The pressures of steam corresponding with the several events of stroke in cylinder, as shown by the indicator card, will be measured by appropriate scale, and the results for each end of each cylinder averaged for each event. The average thus obtained will be corrected for the error of the spring under the conditions and pressure, *i. e.*, whether under increasing or decreasing pressure.

Items Nos. 301 to 304. Indicator cards will be taken from indicator on steam chest, the pressure given is the average pressure of these cards.

Items Nos. 330 to 337. The least back pressure will be measured in the same way as the pressures under Items Nos. 292 to 299, and the results averaged.

The exact location on the card of the point of least back pressure will vary somewhat on different cards of the same test, but the least back pressure will be taken without regard to exact location.

SUMMARY OF AVERAGE RESULTS.

Boiler.

Items Nos. 340 and 341. The "moist steam per hour," Item No. 340, is the average water evaporated by boiler per hour uncorrected for moisture in steam, while "dry steam per hour," Item No. 341, is corrected for moisture by multiplying No. 340 by the "factor (F) of correction for quality of steam."

Item No. 344. The equivalent evaporation from and at 212 deg., pounds per hour, is found by multiplying the dry steam per hour, Item No. 341, by the factor of evaporation.

The factor of evaporation $= \frac{\lambda - q_1}{965.8}$ when

λ = total heat of steam at observed pressure.

q_1 = Heat of feed-water at observed temperature.

Item No. 346. The equivalent evaporation from and at 212 deg., per lb. of coal as fired, is found by dividing the equivalent evaporation per hour, Item No. 344, by the weight per hour of coal as fired, Item No. 233 ÷ Item No. 196.

Item No. 347. The equivalent evaporation from and at 212 deg. per pound of dry coal, is found by dividing the equivalent evaporation per hour, Item No. 344, by the weight per hour of dry coal, Item No. 338.

Item No. 348. The equivalent evaporation per pound of combustible is found by dividing the equivalent evaporation per hour, Item No. 344, by the weight per hour of combustible, Item No. 236 ÷ Item No. 196.

Item No. 349. The boiler horse-power will be found by dividing the equivalent evaporation per hour, No. 344 by 34.5.

Item No. 350. The efficiency of the boiler is found by multiplying the equivalent evaporation per pound of dry coal, No. 347, by 965.8, and dividing the product by No. 248, the number of thermal units in one pound of dry coal.

No credit is given the boiler for heat units used in evaporating moisture contained in fuel as fired.

Engines.

Items Nos. 351 to 358. All indicator cards will be integrated twice by different computers.

After the average mean effective pressure of the indicator cards for each end of each cylinder has been ascertained, the card most nearly approximating the average will be selected to represent the test. In case these cards are subject to correction, resulting from a calibration of the indicator spring, the following method will be used:

Vertical lines dividing the length of card into ten or twelve equal parts will be drawn. At the points where these lines intersect the lines of the card, the card will be corrected (correction curves having been made for each spring); if an increasing pressure, for the error of the spring under similar conditions, if descending, in like manner. A new card will be drawn through the points thus located and the relation of the area of the rectified to the actual card will give a factor which will be used in finding the corrected M. E. P.

The corrected average area of card, divided by the average length of card, and multiplied by the scale of spring used, will give the mean effective pressure.

Items Nos. 359 and 360. Receiver pressure on compound locomotives will be observed by gages attached as closely as possible to the receivers.

Items Nos. 361 to 364. The number of expansions, for simple locomotives, will be found by dividing the volume at release plus the volume of clearance, by the volume at cut-off plus the volume of clearance. For head end of right cylinder, on simple locomotives,

Number of expansions

$$= \frac{\text{No. 276} \times \text{No. 188} + \text{No. 40} \times \text{No. 188}}{\text{No. 268} \times \text{No. 188} + \text{No. 40} \times \text{No. 188}} = \frac{\text{No. 276} + \text{No. 40.}}{\text{No. 268} + \text{No. 40.}}$$

The formula for the other items are similar in form, with the corresponding percentage of stroke substituted.

For compound locomotives, the form of the expression used is as follows, but until the path followed by the steam is known for each locomotive, formulæ cannot be given.

$$\frac{\text{Volume at Release, L. P. Cylinder + Volume of Clearance L. P. C.}}{\text{Volume at Cut-Off, H. P. Cylinder + Volume of Clearance, H. P. C.}}$$

Items Nos. 365 to 372. The indicated horse-power is found by multiplying together the I. H. P. constant, the average revolutions per minute and the mean effective pressure.

For the head end of right high pressure cylinder, the indicated horse-power = No. 180 × No. 198 × No. 351.

The formula for the other items will be similar in form, with the corresponding quantities substituted.

Item No. 381. The dry steam per indicated horse-power per hour is found by dividing the dry steam per hour, Item No. 341, less the steam used by calorimeters or other instruments, by the total indicated horse-power, Item No. 379.

Or if L = pounds of steam used per hour by calorimeters, etc.

$$\text{Dry steam per I. H. P. H.} = \frac{\text{No. 341} - \text{L}}{\text{No. 379}}$$

Item No. 382. The B. T. U. per I. H. P. per hour is found by multiplying the dry coal per I. H.-P. per hour, Item No. 380, by the calorific power of one pound of dry coal, Item No. 248.

Locomotive.

Item No. 383. The dynamometer horse-power is found by multiplying together the D. H.-P. constant, Item No. 179, the average revolutions per minute, Item No. 198, and the average drawbar pull, Item No. 265, or D. H.-P. = No. 179 × No. 198 × No. 265.

Items Nos. 384 to 386. The pounds of coal, steam and B. T. U. per D. H.-P. hour are found in the same manner as the corresponding items for indicated horse-power hour.

Items No. 387 to 389. The number of foot-pounds is found by multiplying together the average drawbar pull, Item No. 265, the average circumference of the driving wheels in feet, Item No. 13, and the total revolutions, Item No. 197.

As the coal, steam, etc., have been reduced to hourly quantities, for convenience, the product obtained by the multiplication in the preceding paragraph will be divided by the duration of tests in hours, Item No. 196, or the foot-pounds at drawbar per hour.

$$= \frac{\text{No. 265} \times \text{No. 13} \times \text{No. 197}}{\text{No. 196.}}$$

Using the figure thus obtained, the coal, steam and B. T. U. per 1,000,000 ft.-lbs. at drawbar is found in a similar manner to Items Nos. 380 to 382.

Item No. 394. Since the I. H.-P., Item No. 379, has already been determined from the mean effective pressure as a basis, the tractive force T can most conveniently be obtained as the product of the constant ratio (33,000 to No. 13) by the variable ratio No. 379 to No. 198 or by formula as follows:

$$T = \frac{33000}{\text{No. 13}} \times \frac{\text{No. 379}}{\text{No. 198}}$$

This may be checked by obtaining the tractive power of each cylinder separately directly from the mean effective pressure, Nos. 351 to 358, and taking their sum; for the high-pressure cylinder, right side, head end, the formula would then be as follows:

$$T_h = 0.7854 \times \frac{\text{No. 351 (No. 32}^2 - \text{No. 78}^2) \text{ No. 36}}{\text{No. 13}}$$

and correspondingly for each of the other cylinders, treating the head and crank ends separately.

Item No. 395. The machine friction of locomotive in terms of horse-power, is the difference between the average indicated horse-power and the average dynamometer horse-power. This does not take into account the friction due to engine truck and trailing wheels and axles.

Item No. 396. The machine friction in terms of pounds mean effective pressure, for simple engines, will be taken as the machine friction in horse-power (No. 395), di-

vided by the average horse-power constant and the average revolutions per minute.

Item No. 397. The machine friction in terms of pounds drawbar pull is the frictional horse-power, No. 395, multiplied by 33,000 to convert it into foot-pounds, divided by the distance in feet per minute. Or machine friction in terms of pounds drawbar pull

$$= \frac{\text{No. 395} \times 33{,}000}{\text{No. 198} \times \text{No. 13}}$$

Item No. 398. The machine efficiency of locomotive in per cent. will be taken as 100 times the ratio of the D. H.-P., No. 383, to the I.H.-P., No. 379.

Item No. 399. Efficiency of locomotive will be found by dividing the heat equivalent of one horse-power for one hour, by the B. T. U. per dynamometer horse-power hour, No. 386, shown by test. This quantity multiplied by 100 will be the efficiency in per cent.

Efficiency of locomotive per cent.

$$= \frac{254498.7}{\text{No. 386.}}$$

CALIBRATION OF INSTRUMENTS.

Indicators.

An approved type of inside spring steam engine indicator has been purchased.

Indicator springs have been tested on steam drum with automatic dead weight valve, in which the volume of the steam remains practically constant, and the pressure may be varied by changing the weights on the valve.

Each spring has been tested, and the errors noted both for ascending and descending pressures at intervals of 10 lbs. throughout the range of the spring. These tests will be repeated at intervals of one week throughout the period of the tests, unless by reason of unsatisfactory results it is found necessary to make tests at shorter intervals.

All indicators have been tested for parallelism of pencil movement, by removing the spring, and pushing the pencil to the top of card and allowing it to fall, at several points on the circumference of the drum.

The perpendicularity of these vertical lines to the longitudinal line drawn by revolving the drum with the pencil motion to its lowest position, and the parallelism of the vertical lines to each other show the correctness of the parallelism of the pencil movement.

The parallelism of the piston movement to the drum axis with the spring in place is determined by verifying the angle between the atmospheric line and a steam line made with the drum at rest.

By the use of a device similar to the Brown drum spring testing device, diagrams for various tensions of drum springs have been obtained, and before each test, diagrams of the drum spring tension for each indicator will be taken and the tension adjusted to give the best results at the speed at which test is to be run.

The influence of the inertia of the moving parts of the indicators has been ascertained by taking cards at very slow speeds, and others at the highest speed which will be attained; the difference in length of the card shows the influence of inertia.

Steam Gages.

All steam gages have been tested at intervals of 10 lbs. on dead weight gage tester, and errors noted both for increasing and decreasing pressures. The recording steam gage has been tested in the same way, no readings being taken unless piston of tester was revolving.

Steam Calorimeters.

A design of throttling-calorimeter, which has been approved by Prof. Peabody, and which is essentially a Peabody calorimeter, has been made, and three calorimeters were manufactured on this design.

The calorimeters have been tested to a water pressure of 400 lbs., and made tight at that pressure.

Removable orifices have been provided, which will deliver about 200 lbs. of steam per hr., the diameters of the eleven sizes of orifices being appropriate for pressures ranging from 180 to 250 lbs. The deliveries of these orifices have been carefully calibrated by a coil condenser, all the steam passing through calorimeter being condensed and weighed.

The calorimeters are lagged with an asbestos cover, 2½ in. of hair felt and a casing of Russia iron outside of the hair felt.

No correction will be made for radiation from the calorimeter.

Weighing Scales.

Standard weights have been provided with which all scales will be tested at intervals of one month, or oftener, if the results indicate the necessity for more frequent tests.

Water Meters.

Both water meters have been tested by passing water through them, and weighing the water, and observing the temperature.

Tests have been made at rates of flow varying from 3 to 15 cu. ft, per minute, both for intermittent and continuous flows.

The correction factor, for the average rate of flow during the test will be used in comparing the results of metering and weighing the feed water.

The pyrometers for measuring fire-box and smoke-box temperatures consist of thermo-couples, each couple being composed of a junction of platinum with platinum-rhodium wire, forming the pyrometer Le Chatelier.

The temperature reading is obtained by means of a milli-voltmeter showing the electromotive force set up in the thermo-couple, when heat is applied. The couples and milli-voltmeter have been compared with the official standards of the Bureau of Standards at Washington, D. C., and all temperature readings will be corrected by reference to their certificate.

Thermometers.

Thermometers have been provided as follows:

Six reading from 0 to 212 deg. F. for feed water.

Ten reading from 0 to 400 deg. F. for calorimeters.

Six reading from 0 to 600 deg. F. for calorimeters.

Four reading from 0 to 500 deg. F. for smoke-box.

Of these thermometers, two of each kind have been calibrated at a number of points throughout their respective ranges, by the Bureau of Standards, Washington, D. C., and these certified thermometers will be recalibrated at intervals and will be used as standards for the determination of the errors of all other thermometers used.

Barometer.

For observation of the atmospheric pressure, a mercurial barometer will be used. This instrument has been calibrated by the Bureau of Standards, Washington, D. C., and a curve of true pressure has been plotted which will be used to correct all readings.

Draft Gages.

"U" tube gages containing water will be used to obtain the smoke-box, fire-box and ash-pan pressures. The gages have been tested by the Bureau of Standards, Washington, D. C., for accuracy of graduation of scales and uniformity of bore of tubes. These corrections have been plotted and will be applied to all readings.

To measure the lower pressures in the calorimeters single tube mercury pressure gages will be used. These gages have a range from 0 to 7 lbs. per sq. in. and have been tested by the Bureau of Standards at Washington, D. C., for accuracy of scale readings and uniformity of bore of tube, and the plotted curve of these tests will be used to correct all readings.

Coal Calorimeter.

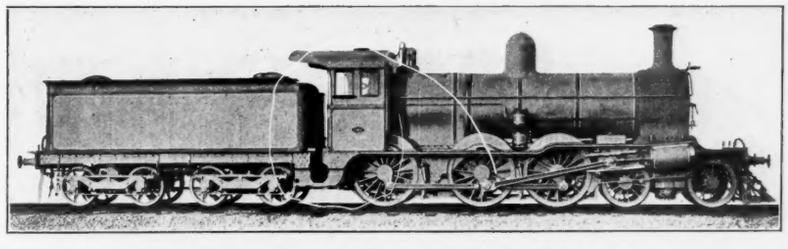
The calorimeter to be used is the William Thompson calorimeter with some slight modifications to facilitate working and output. This calorimeter has been standardized by testing in it two samples of coal which were previously tested in ten different bomb calorimeters, including a test in the bomb calorimeter at the Bureau of Standards, Washington, D. C. The mean of these ten determinations is taken as representing the heat units in these two coals, and these coals when tested in the Thompson calorimeter, enable it to be standardized so as to give results the same as the bomb calorimeter. Furthermore, a sufficient amount of these two coals has been prepared so that the Thompson calorimeter can be frequently checked. It also provides a means of ready standardization, in case of accident to any of the parts of the Thompson calorimeter, or in case of getting a new instrument complete.

Orsat Apparatus for Analysis of Smokestack Gases.

The Orsat apparatus to be used in analyzing the smoke-box gases has had its measuring pipette carefully calibrated by filling with water at room temperature, and then weighing this water as a whole and in successive portions corresponding to the graduations on the measuring pipette. The necessary corrections, where any were found requisite, will be used in reading the percentages from the measuring pipette.

Rolling Stock on the Victoria State Railways.

Mr. T. H. Woodroffe, Chief Mechanical Engineer of the Victoria Government Railways, sends us the accompanying photograph of one of the new 10-wheel locomotives recently designed by him. These engines are intended for passenger and freight service on the main and branch lines and are of only moderate weight. Eleven of this design have already been turned out of the railroad company's shops, ten more are under construction in the company's shops and seven are being built by contract in outside shops at Melbourne. With the excep-



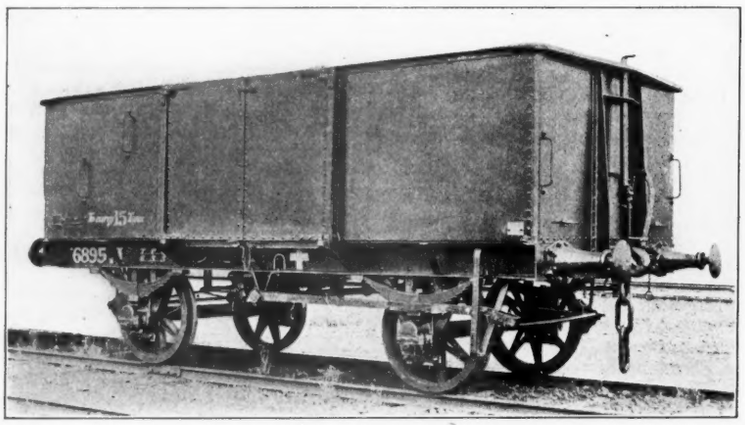
New Ten-Wheel Locomotives for Victoria State Railways.

tion of one or two special engines, these are the first that have been built in the company's shops, all of the motive power for the lines having been bought from outside concerns in Victoria. The engines have the following principal dimensions:

Gage	5 ft. 3 in.
Cylinders	18 in. x 26 in.
Valves	Piston
Diameter of drivers	60 in.
Driving wheel base	13 ft.
Engine wheel base	24 ft. 3½ in.
Total wheel base, engine and tender	48 ft. 4 in.
Grate area	22.5 sq. ft.
Fire-box heating surface	120 sq. ft.
Tube heating surface	1,288 sq. ft.
Total heating surface	1,408 sq. ft.
Working steam pressure	175 lbs.
Water capacity of tender	4,000 imp. gallons
Coal capacity of tender	5 tons
Weight on drivers	84,000 lbs.
Total weight of engine	114,240 lbs.
Weight of tender	89,600 lbs.

The engine has a Belpaire boiler with copper fire-box and brass tubes.

The other illustration shows the standard goods wagon in use on the Victorian Railways. It is built entirely of steel and has a marked capacity of 15 long tons. It has a cubic capacity of 687 cu. ft. and will carry 15 tons of coal, wheat in bulk or similar articles. The tare weight of these cars is from 13,200 lbs. to 14,000 lbs., depending on the weight of the wheels on which they are mounted. These and all other cars for passenger and freight service are built in the company's own shops.



Standard 15-ton Car, Victoria State Railways.

A number of all-metal cars built as far back as 1860 and 1870 are still in use on this road and all new cars and replacements have been built of steel throughout for several years past. There are now about 2,000 in service. This company's experience has been that in Victoria, at least, all-metal cars can be built for less money, their cost of maintenance is considerably less, damage from collision more easily repaired, and the ultimate life more than double that of wooden or composite cars.

Inside Cylinder Locomotives.

BY F. W. DEAN.

The appearance in this country of a number of locomotives having inside and outside cylinders, shows that the dislike of the crank axle is not so strong as to prevent its use if any important end is thereby accomplished. The only argument that I have ever heard against crank axles is that they are unreliable. The persistency of their use in England shows that this is not so. On American locomotives there are important parts which are as unreliable and troublesome as crank axles. Present methods of construction and present qualities of materials have made the crank axle safe for locomotive use. Large locomotives are giving much trouble by breaking cylinders, and the repair bill for this item is serious. A great part of this expense can be saved by building locomotives with inside cylinders. The present simple locomotive is an exceedingly wasteful machine from cylinder condensation, and is proportionately lacking in speed therefrom. The inside cylinder locomotive will reduce this condensation and the speed will be increased on account of absence of sluggishness of wet steam and the greater ease of keeping up boiler pressure. The nosing of the engine will be reduced and the wear of wheel flanges, wheel hubs, axle box flanges and axle collars will be diminished, and possibly rails will have increased life. The internal friction of the engine will also be reduced.

In large locomotives the centers of outside cylinders are so far apart, and the points of fastening of the frames are so near the center of the engine that the strain on the neck of the cylinder casting is so great, considered as a girder, that it cannot be met except by increasing the dimensions, which has several disadvantages. There are initial strains in the foundry and strains from the heating and cooling of the castings in service which almost inevitably crack cylinders. The cast-iron overhung girders that the cylinders form would be tolerated in scarcely any other structure, and especially in one which is subjected to the frequently repeated and violent dynamic strains of locomotive cylinders. The inside cylinder forms a girder which is supported at the ends by the frames and loaded between, and is therefore good engineering construction. It is deep necessarily in proportion to its length and forms a satisfactory girder for taking the load, while its outside companion is remarkably bad in this respect. Incidentally, there may be a reduction of some importance in cylinder breakages from the absence of overhung cylinders fouling the cylinders of other engines, cars, etc. The reduction in weight would be most important, amounting in many cases to 4,000 or 5,000 lbs.

There would, of course, be a limit to the size of cylinders, but 23-in. cylinders can be used, if we can judge by the size of the inside low-pressure cylinders of French four-cylinder compound locomotives. With the long stroke that is now used sufficient cylinder volume for most cases can be obtained, especially with the very high steam pressures now carried. As locomotives are now built with fire-boxes whose length is not limited by the axles, the crank axle even of a long stroke engine will not reduce the grate area, nor will it force the height of the boiler above present limits.

There is something lacking in the present large engines. They do not accomplish what they ought, and something radical ought to be done to make them better mechanical structures, to economize steam and to make them steam better. The adoption of inside cylinder locomotives will do a great deal to bring this and all of the above-mentioned advantages to realization. As long ago as 1895 the late J. N. Lauder told the writer that if it were not for the crank axle he would begin to build inside cylinder locomotives.

The crank axle can be designed in several different ways, but I should prefer a built-up axle, made of nine pieces, crank arms, crank pins and straight pieces of the axle all separate, forced together with tapered fits and keyed, as is frequently done in marine practice. This method is used by the Lancashire and Yorkshire, of England. By doing away with eccentrics on the axle a center bearing can be used, and this will reduce the strain on the axle. Doing away with eccentrics, of course, raises the question as to the design of the valve gear. I hope that the appearance in this country of the Mallet and DeGlehn four-cylinder compounds, both with Walschaert valve gear, will bring about the use of this admirable device. It is a more scientific gear than the Stephenson, which is a reversing makeshift. In order to render the center bearing of the crank axle possible the Walschaert gear can be driven by a return crank from the outside crank pin.

Referring still further to the limit of size of inside cylinders, occasionally in England and on the continent, there are seen locomotives with outside frames, and such locomotives have been built in this country for narrow-gage railroads, by the Baldwin Locomotive Works. With such frames inside cranks far apart can be used with a center bearing, and ample room for the largest cylinders can be provided. There will also evidently be room enough for eccentrics on the axle each side of the center bearing. Such locomotives, although they would look strange to our eyes, would have all of the advantages which the inside cylinder locomotive possesses.

Guard Rail Brace.

The illustration shows a serviceable guard rail brace, with the special feature of raising the guard rail higher than the running rail or guarding a heavy rail with a light one. Frequently much trouble and delay is occasioned by slight accidents due to the conditions of guard rails, and considerable wear and tear on frogs is caused by the guard rail not remaining rigid. These conditions can be remedied by using a guard rail brace that supports the guard and running rail, as well as braces the guard rail and directly connects the guard and running rail. These guard rail braces are furnished either with or without bolts or filler blocks, and can be supplied to cover any conditions specified, whether it is desired to raise the guard rail or not. They are made by the G. H. L. Rail Joint Co., 150 Nassau street, New York.

G. H. L. Guard Rail Brace.

GENERAL NEWS SECTION

THE SCRAP HEAP.

Telephoning from Moving Cars.

The American Car Telephone Company announces that it is going to put telephones on the cars of the St. Louis, St. Charles & Western, an electric railroad running between St. Louis, Mo., and St. Charles, about 20 miles, and that a line will be constructed for the purpose of telephoning from stations or offices along the road to persons on the cars. It appears that connection between the car and the roadside is to be made by a separate trolley and trolley wire.

A New Naval Cruiser.

The armored cruiser South Dakota was launched on July 21 at the Union Iron Works, San Francisco. The South Dakota is of the same tonnage as the Colorado and Maryland, and was authorized by Congress at the same time. She is 502 ft. long, 69 ft. 6½ in. beam, and draws 24 ft. of water, with a displacement of 13,600 tons. Her engines are to develop 23,000 I.H.-P. with twin screws. The total cost of the ship, including armor, will be about $5,000,000.

Opening of the Trent Hydraulic Lock.

The official opening of the hydraulic lift lock on the Trent canal, at Peterborough, Ontario, took place July 9. The Trent waterway consists of a series of lakes and rivers connected by artificial canals, connecting Midland harbor, at the southern end of Georgia Bay, with Trenton, on the Bay of Quinté, which leads to Lake Ontario. The Peterborough lock, which has a lift of 65 ft., is the largest hydraulic lift lock in the world. It was fully described in the *Railroad Gazette* March 25, 1904.

Rates on Cattle to New Orleans.

The Interstate Commerce Commission, in an opinion by Commissioner Prouty, has announced its decision in the case of the New Orleans Live Stock Exchange vs. the Texas & Pacific. The rate on beef cattle c.l. from Ft. Worth to New Orleans is 42½ cents per 100 lbs., and $15 per car additional when shipment is made in lots of less than ten carloads. Complaint was made against the imposition of the additional $15 per car. The Commission holds that such charge, in addition to the 42½-cent rate, is unreasonable when applied to single carloads.

New Fall River Liner.

The new steel passenger steamer Providence, which is being built for the New York, New Haven & Hartford Railroad at the Fore River Ship & Engine Works at Quincy, Mass., was launched July 16. The steamer Providence, which formerly ran on the line, was built in 1866, and broken up in 1901. The new vessel is a side-wheel steamer, 397 ft. long, and her total cost will be nearly $1,000,000. She will be 88 ft. wide over all at the guards. In general dimensions and appearance the Providence will be similar to the Priscilla, at present the flagship of the Fall River Line.

Coal Rates to Dallas and Denison.

The Interstate Commerce Commission, in an opinion by Commissioner Prouty, has announced its decision in the case of the Denison Light & Power Company vs. the Missouri, Kansas & Texas. The power company alleged that the rate charged on coal from the McAlester district, Indian Territory, to Denison, Tex., was unreasonable and also discriminates in favor of Dallas. The Commission found that competitive conditions exist at Dallas which force the lower rate upon the carrier, and therefore that the case did not present any question of discrimination; but it found the carrier's rate of $1.90 per ton on coal from South McAlester to Denison, a distance of 97 miles, unreasonable; it should not exceed $1.25.

Rates from St. Louis to Starkville.

The Interstate Commerce Commission, in an opinion by Commissioner Yeomans, has announced its decision in the case of the Aberdeen Group Commercial Association against the Mobile & Ohio. The road is justified in making lower rates on freight from St. Louis, East St. Louis and Cairo, to Mobile and Meridian than for the shorter distances to Tupelo, Aberdeen, Columbus, West Point and Starkville, by actual and controlling competition which creates substantial dissimilarity in the conditions. The rates on freight generally from St. Louis, East St. Louis and Cairo to Tupelo, Aberdeen, Columbus, West Point and Starkville are not found, as a whole, to be reasonable and just, nor on the other hand to be altogether unreasonable; but upon the facts shown its rates upon grain and grain products are unreasonable, unjust and unlawful and should be reduced.

A Remarkable Run on the Burlington.

The special train of six cars, which carried Mr. Paul Morton, the new Secretary of the Navy, to Washington, last week, made a fast run over the Burlington from Creston, Iowa, to Chicago. The train left Creston at 10 o'clock Saturday night and arrived in Chicago, 510 miles, at 7 o'clock Sunday morning, covering the distance in about nine hours. It was pulled all the way by engine No. 2700, one of the new Baldwin four-cylinder compound Atlantic type locomotives, described in the *Railroad Gazette*, June 3, and, according to newspaper reports, the run was made without stopping to clean fires. About ten tons of coal were burned and when the engine had completed the run and dropped the train at the station in Chicago, it was run out to Aurora before the fire was cleaned. Officers of the road are quoted as saying that the run was in nature of an experiment to see whether the engine could stand the long trip and that further trials will be made along the same line.

Air-Brakes on P. R. R. Freights.

The Pennsylvania railroad has reduced the number of men in the crews on a large number of freight trains, and in consequence of this change and of the falling off in business at certain points, the company has dismissed or furloughed a considerable number of trainmen. These facts have been made the subject of a great number of news items, padded with alleged grievances of the brotherhoods; but, so far as can be learned, the proportion of men dismissed has not been large, the reductions not touching any of the trainmen who have been in the service as long as five years, and very few of over two years' standing. The reduction in the size of the crews appears to be exactly the same as that which was made on the New York Central several years ago. As was said at that time, the increased use of the air-brake furnished the logical justification for a decrease in the number of brakemen. Officers of the Pennsylvania, explaining to the reporters the present action of that company, say that the occasion of the order is the Federal law requiring 50 per cent. of the cars in each train to be air-braked. This law did not go into effect throughout the lines of the Pennsylvania until the first of the present month, the company having been granted an extension of time by the Interstate Commerce Commission. It appears that until this month the rule requiring air-braked cars to be placed in the front of freight trains was not enforced on all divisions of the Pennsylvania, so that the first of July marked a radical change in train working. On certain divisions where grades are steep the number of trainmen has not been reduced.

Navy Yard Improvements.

Bids were opened by the Bureau of Supplies and Accounts, Navy Department, on July 5 at Washington, for about 180,360 lbs. of steel castings, 203,926 lbs. of steel forgings, and granite, for the extension of the electric power plant at the Washington Navy Yard. The lowest bidders were: For steel castings, the Seaboard Steel Casting Co., of Chester, Pa., $6,132.24; for steel forgings, the Midvale Steel Co., of Philadelphia, $45,874.20, and for granite, Antonio Malnati, of Washington, $8,390. There were 17 bidders in all.

The Navy Department has bought a large tract of land adjoining the Norfolk Navy Yard at a cost of $400,000, to be used as a part of the extensive improvements which it is expected will make the Norfolk Navy Yard the largest in the world. On the land just bought will be built marine barracks, dry docks, fresh water basins, etc., and it will also be necessary to widen the channel from Hampton Roads to the Navy Yard.

Clearing the Washington Blockade.

Railroad officials in Washington are talking of a feat performed by George R. Lee, Chief Train Despatcher of the Pennsylvania, which they say has made a record. It was in relieving the local railroad yards of a badly congested condition, such as often arises at large terminals, which brought Lee into prominence in Eastern circles and caused the officials of the Southern to present him with an annual pass with a very complimentary letter. During the latter part of May a blockade occurred in the Washington freight yards. Never before had there been such a congestion. Freight cars were held up by the hundred, and the local officials were tearing their hair. Something had to be done, and done quickly. On May 25 Lee was sent for and told to take charge of the situation and clear the yards. At that particular time there were about 1,000 Washington cars coming into the yards every day. In addition to these through freight trains from the South going north with perishable fruit and vegetables were pouring in constantly. Lee had 31 freight engines and crews to work with, and he began double heading and sending the cars out as fast as they came in. As soon as a Washington car was emptied Lee would start it for Bay View, Md., which is six miles beyond Baltimore. There the engines would leave it and come straight back to Washington. He gave the crews 11 hours to get to Bay View and back, and they were paid overtime if it took longer. While the train crews were taking a 12-hour lay-off the engine crews were taking the empty box cars out of the Anacostia yards to Bay View.

All this time there were 500 cars coming direct to Washington daily, and going out, cars whose contents were assigned to firms in this city. Lee gave them his attention

and kept them on the move with his engines. The through trains likewise received similar care. There were from 2,000 to 5,000 of these cars daily. From May 25 to June 27, when the congestion was finally cleared, Lee moved nearly 63,000 cars in and out of Washington. The record for one day was 2,390, and the daily average about 2,100. The amount of money paid out for overtime work during the month of May, before Lee took hold, was $5,000. For the month of June it was $1,500. For the month of June, which practically comprised Lee's time of control, there were 40 per cent. more cars moved in and out of Washington than for any previous month in the history of the Pennsylvania Railroad.—*Leonard's Railway News.*

Rates on Bananas to Danville and Lynchburg.

The Interstate Commerce Commission, in an opinion by Commissioner Prouty, has announced its decision in the case of Gardner & Clark against the Southern Railway. The rates per 100 lbs. on bananas c.l. from Charleston, S. C., are 43 cents to Danville, Va., and 35½ cents to Lynchburg, the transportation to the latter point by defendant's line being through Danville. The lower rate to Lynchburg is forced upon defendant by the competition of bananas coming from Baltimore. The 43-cent rate to Danville is not found to be unreasonable, and upon these facts the higher rate to Danville is not in violation of the Act to regulate commerce.

Prior to April 25, 1903, defendant charged 43 cents to Danville and 20 cents to Lynchburg, the latter being 13 cents below the rate, which was justified by competition from Baltimore or elsewhere. Such relation of rates was in violation of sections three and four of the Act to regulate commerce, and complainants, upon the shipments made at the 43-cent rate to Danville, are entitled to recover reparation to the extent of 13 cents per 100 lbs., such excess amounting upon complainant's shipments to $130.

Upon 17 carloads of bananas defendant allowed complainants to ship between May 1, 1902, and April 25, 1903, from Charleston to Lynchburg and unload half of the carloads at Danville, paying the Lynchburg rate plus the local rate on the half carloads carried from Lynchburg to Danville. This was in disregard of defendant's regulations and resulted in charges below those applicable under defendant's published tariff. Complainants seek reparation upon the basis of the Lynchburg rate, and defendant upon the basis of its tariff rate, but neither is entitled to recover.

Manufacturing and Business.

A quarterly dividend of $2 per share from net earnings has been declared by the Pullman Company, payable August 15, to stockholders of record at close of business July 30.

Templeton, Kenly & Co., Chicago, have removed their offices from The Rookery to 33-37 East Ontario street, having consolidated them with their shops and warehouses at this point.

The Columbia Anti-Friction Metal Company, of New York City, has been incorporated with a capital of $100,000. The directors are: J. B. Shannon, C. R. Sickles and W. H. Reynolds, all of New York City.

Sealed proposals will be received at the office of the Sewer Committee, in the Borough of Lewistown, Pa., until 2 p. m. on August 20, 1904, for the construction of sewers in Lewistown. See advertisement.

The Davenport Locomotive Works, of Davenport, Iowa, has just let a contract for two additions to its present forge and woodworking shops. These additions are made because of the large increase in business during the last six months.

Hydrex Waterproofing Felt, made by F. W. Birds & Son, East Walpole, Mass., was used to waterproof the foundations of the new Lehigh Valley shops at Sayre, Pa. Hydrex is also specified for the Pennsylvania Railroad tunnel under the North and East Rivers, New York City.

Announcement has been made that the United States Steel Company, of Everett, Mass., has been reorganized under the name of the Massachusetts Steel Casting Company, with a capital of $500,000. This company recently was sold under foreclosure proceedings brought by the International Trust Company.

The International Garbage Crematory Co., Buffalo, N. Y., is making an improved form of incinerator which uses oil as fuel. These machines are used for the sanitary disposal of waste and are claimed to be absolutely odorless. The machines are simple in design and may be taken apart and put into small bulk for shipment. They are adapted for use in railroad stations and contractors' camps.

Dodge & Day, modernizing engineers, Philadelphia, have just completed the installation of the 340-h.-p. Buckeye vertical, cross-compound engine, direct connected to two G. E. 100-k.w. continuous-current, compound-wound generators for the Link-Belt Engineering Company. The same concern is at work on a three-motor, electrically-operated locomotive crane for this company, to handle beams, angle irons and other heavy structural material for use in their new storage yard.

A contract has been let to the Ingersoll-Sergeant Drill Co. by the O'Rourke Engineering & Construction Co. for two simple compressed air power plants to be used on either side of the Hudson River, New York City, where the shafts of the Pennsylvania Railroad tunnel have been sunk. These plants will include eight duplex Corliss air-compressors and will be used for driving all the machinery in the tunnel and for maintaining the necessary pressure when operating the shields.

It is reported from Guadalajara, Mexico, that Ralph H. Beach, formerly of the General Electric Co., and George Townsend, of Indianapolis, are interested in the development of a new company to produce steel. The company has leased for 10 years lands in the Ferreria de Tula district, which embraces a large table land with two deposits of iron ore, with the option of buying for $700,000. The property also includes a foundry, rolling mill and machine shop now in operation. It is proposed to increase the capacity to 50 tons a day. J. E. Jones, of the Phœnix Roller Mills, of Pittsburg, it is said, will be General Manager of the works.

The Allis-Chalmers Company is said to have obtained a contract for installing nearly 100,000 horse-power turbo-generating equipment, valued at about $2,000,000. The contract is reported to have been awarded by Thomas E. Murray, acting as consulting engineer for the Brooklyn Rapid Transit Company and the New York Edison Company, of New York. There will be six 5,500 k.w. turbines, direct connected to 25-cycle 750 r.p.m. three-phase alternating generators. The latter machines will be wound to give either 6,600 or 11,000 volts. One is to be installed in a large power house which the Brooklyn Rapid Transit is to erect at Kent and Division avenues, Brooklyn, and which will contain almost 100,000 horse-power. Twelve turbines in all are to be put in the plant. The second largest contract of the kind was for three 5,500 k.w. outfits, which the Westinghouse Company will furnish for the proposed Long Island City power house of the Pennsylvania Railroad.

Bids are wanted by the Bureau of Supplies and Accounts, Navy Department, on August 9 for furnishing machine tools at the navy yards at Portsmouth, N. H.; Boston, Mass.; New York, N. Y., and League Island, Pa., and on August 23 at the Mare Island and Puget Sound navy yards, to include engine lathes, planers, grinders, molding machines, sawing machines, bending machines, drilling machines, woodboring machines, tenoning machines, feed pumps, steam winches, warping engines, a switching locomotive, grindstones, drill presses, drills, saws, centering machine, cutters, riveters, punches, retoothing machine, hairpicking machine, saw stretcher, sandpapering machine, box-pressing machine, electric motors and steam hammer.

Iron and Steel.

At a meeting of the directors of the United States Steel Corporation on July 27, the regular dividend of 1¾ per cent. on the preferred stock of the company was declared. Net earnings for April, May and June were $19,490,725, an increase of $6,281,839 over the first quarter of the year, but a decrease of $17,008,803 as compared with the June quarter of 1903. The unfilled orders on the books of the company at the end of the June quarter amounted to 3,192,277 tons, which is a decrease of 944,684 tons as compared with the orders on hand at the end of the quarter on March 31 last. Thomas Morrison, of Pittsburg, was elected a director in place of Charles M. Schwab, resigned.

PERSONAL.

—Mr. George W. Vallery, who succeeds Mr. Schlacks as General Manager of the Colorado Midland, has for the past 13 years been General Agent for the Chicago, Burlington & Quincy at Denver. Mr. Vallery is 43 years old, and was born at Plattsmouth,

Neb. He began work as a messenger on the Burlington & Missouri River in his native town, and remained as such until 1876, when he went to Lincoln as locomotive fireman. In 1881 he went to Kansas City and went to work in the freight department of the Union Pacific, but shortly returned to the Burlington as a clerk in the General Agent's office at Denver. From there he went to Cheyenne and Salt Lake City, but in 1891 returned to Denver as General Agent, which position he now leaves to go to the Colorado Midland.

—Mr. Robert Du Bois McCreary, for many years Chief Engineer of the Western New York & Pennsylvania, now a part of the Pennsylvania, died recently at East Aurora, N. Y. Mr. McCreary was born at Great Bend, Pa., 71 years ago, and entered railroad service in 1850 as assistant leveler for the Delaware, Lackawanna & Western. Six years later he was Principal Assistant Engineer on the Macon & Brunswick, and in 1857-8 was Assistant Engineer on the Dubuque & Pacific. Then for about four years he was on the Erie, but in 1865 was made Chief Engineer of the Oil City & Pithole. For six years from 1867 he was on the Allegheny Valley, two years in the freight department, one year as train despatcher and three years as freight and passenger agent. In 1880 he was appointed Chief Engineer of the Buffalo, Pittsburg & Western; in 1884, Chief Engineer of the Buffalo, New York & Philadelphia, and Engineer of Maintenance of Way of the Western New York & Pennsylvania, and in 1892, Chief Engineer of the latter road. In August, 1900, when the road passed into the control of the Pennsylvania, he was made Engineer of Right of Way.

—Mr. Burns Daniel Lockwood, the new Mechanical Engineer of the Cleveland, Cincinnati, Chicago & St. Louis, with office at Indianapolis, is a native of Buffalo, N. Y., and is 37 years old. Mr. Lockwood was educated at Heathcote Academy in that city, and began his railroad service in 1887. He began as an apprentice at Ludlow, Ky., on the Cincinnati, New Orleans & Texas Pacific, and remained with that company for about six years as Draftsman and Engineer of Tests.

In 1893 he resigned and shortly after went to Cincinnati as special designer and constructing engineer for the Weir Harden Engine Company. In 1897 he went back to the Big Four, where for five years he was Chief Draftsman; but in 1902 he left and since that time and until the present appointment he has held a similar position on the Louisville & Nashville at Louisville.

—Mr. Russell Harding, who has been elected President of the Pere Marquette to succeed Mr. Prince, was born in 1856 at Springfield, Mass. He entered the railroad service in 1870, beginning on construction work, and until 1880 was with the Portland & Ogdensburg. For about six years (1880-1886) he was connected with the International & Great Northern in various capacities, and from 1886 to 1894 was in the service of the Missouri Pacific. Then he left that road and for the next four years was on the Great Northern; first as Superintendent of the Dakota Division at Grand Forks, N. Dak.; then General Superintendent of the Western District at Spokane, Wash., and then for about a year and a half General Superintendent of the whole line. In 1898 he left the Great Northern to re-enter the service of the Gould System, and was made Vice-President and General Manager of the St. Louis Southwestern. In March, 1900, he was promoted to the position of Third Vice-President and General Manager of the Missouri Pacific System. For several months past he has also been General Manager of the Denver & Rio Grande, but in the early part of June he resigned from this position to devote his entire

attention to the M. P. Mr. Harding has made a fine record in the operating department of the Missouri Pacific and to him is due much of the credit for the improvements which have been carried out on that road under his direction. A man of charming personality, but alert, and a sharp and strict taskmaster, his knowledge of all of the minute details of railroad construction and management, together with his ability in the management of men and his great personal capacity for work, well fit him for his new duties.

ELECTIONS AND APPOINTMENTS.

Chicago, Burlington & Kansas City (C., B. & Q.).—The position formerly held by A. C. Goodrich, Manager, has been abolished, and Mr. Goodrich has been assigned to other duties.

Chicago, Burlington & Quincy.—J. W. Mulhern, hitherto Superintendent of Terminals at Kansas City, has been appointed Superintendent of the Hannibal division, with headquarters at Hannibal, Mo., succeeding C. A. How, resigned. A. V. Brown has been appointed Superintendent of Terminals at Kansas City, succeeding Mr. Mulhern.

G. T. Ross has been appointed Superintendent of Station Service. This is a newly created office, and Mr. Ross will travel over the entire system.

Chicago, Rock Island & Pacific.—C. L. Brown has been appointed Superintendent of the Dakota division, with headquarters at Estherville, Iowa, succeeding G. A. Merrill. H. M. Hallock has been appointed Superintendent of the Oklahoma division, with headquarters at Chickasha, Ind. T., succeeding T. H. Beacom, who has been appointed Superintendent of the St. Louis division, with headquarters at Eldon, Mo. J. G. Jennings has been appointed Superintendent of Telegraph, with offices at Chicago.

Cincinnati, Hamilton & Dayton.—G. M. Cumming has been elected Chairman of the Board of Directors and Russell Harding has been appointed Vice-President and General Manager. (See Missouri Pacific.)

Des Moines & Fort Dodge (C., R. I. & P.).—Edwin Hawley and others connected with the Minneapolis & St. Louis have bought a controlling interest in this company and the following have been elected directors: Edwin Hawley, F. H. Davis, L. F. Day, H. E. Huntington, George Crocker, L. C. Weir, C. Lorch, Walter I. Crandall and A. C. Doan. The new officers are as follows: President, Edwin Hawley; Vice-President, L. F. Day; Treasurer, F. H. Davis, and Secretary, W. I. Crandall.

El Paso & Southwestern.—A. Struthers, Master Mechanic, has resigned.

Mexican.—C. F. Melick has been appointed General Freight and Passenger Agent, with headquarters at Mexico, Mexico, succeeding A. L. Van Antwerp, resigned.

Midland Valley.—J. F. Elder has been appointed General Freight and Passenger Agent, with headquarters at Ft. Smith, Ark., succeeding F. M. Richardson, resigned.

Missouri Pacific.—Russell Harding, Vice-President and General Manager, has resigned. (See Pere Marquette and Cincinnati, Hamilton & Dayton.)

Pere Marquette.—Russell Harding, hitherto Vice-President and General Manager of the Missouri Pacific, has been elected President of the P. M., succeeding F. H. Prince, resigned.

Pullman Company.—T. E. Kinsey has been appointed District Superintendent, with office at Philadelphia, and W. M. Camp has been appointed to succeed Mr. Kinsey as District Superintendent at Atlanta, Ga.

St. Louis & San Francisco.—H. F. Clark, hitherto Superintendent of Terminals at Kansas City, has been appointed Superintendent, with headquarters at Neodesha, Kan., succeeding J. A. Quinn. J. E. Hutchinson, hitherto Trainmaster, has been appointed to succeed Mr. Clark at Kansas City.

South Dakota Central.—L. H. Stiles has been appointed Superintendent and Traffic Manager. This road is a new one now building from Sioux Falls to Madison. (See Railroad Construction column, July 1, p. 24.)

LOCOMOTIVE BUILDING.

The Denver, Northwestern & Pacific is reported in the market for 10 locomotives.

The Western Pacific, according to press reports, is in the market for 10 freight locomotives.

The Chicago & North Western is having 12 passenger locomotives built at the Schenectady Works of the American Locomotive Co.

The Lake Shore & Michigan Southern is having 15 locomotives built at the Brooks works of the American Locomotive Co. and not at the Baldwin Locomotive Works, as reported in our issue of July 22.

CAR BUILDING.

The American Car & Foundry Co. has miscellaneous orders for 22 cars.

The Southern is reported to have ordered 3,000 cars from Haskell & Barker.

Schwarzschild & Sulzberger is reported to be figuring on 100 refrigerator cars.

The Western Pacific, according to press reports, is in the market for 200 ballast cars.

The Cuba Company has ordered one sleeping car from the American Car & Foundry Co.

Nelson, Morris & Company are reported as going to build 100 refrigerator cars in their own shops.

The Buffalo Mercantile Company has ordered 100 flat cars from the American Car & Foundry Co.

The Denver, Northwestern & Pacific is reported in the market for 10 passenger coaches and 500 freight cars.

The Minneapolis St. Paul & Sault Ste. Marie has ordered 200 box cars from the American Car & Foundry Co.

The Pittsburg Provision & Packing Company is having 12 freight cars built at the Chicago Works of the American Car & Foundry Co.

The Sterling Company, Chicago, has ordered forty 80,000-lb. flat cars from the Western Steel Car & Foundry Co. Special equipment includes: Westinghouse air brakes, Tower malleable iron couplers, Commonwealth Steel Co.'s body and truck bolsters, Miner draft rigging, Western Steel Car & Foundry Co.'s brake-beams, Griffin wheels, McCord journal boxes and gravity side bearings.

The Norfolk & Western has ordered 20 coaches from the Pullman Co. These coaches will be built of wood and will weigh about 80,000 lbs. They will be 62 ft. 6½ in. long over end sills, 9 ft. 8¾ in. wide over side sills and 14 ft. 1¼ in. high over all. The special equipment includes: Cast iron brake-shoes, Westinghouse brakes, Janney couplers, Edwards curtain fixtures, Pantasote curtain material, N. & W. bolsters and brake-beams, Pintsch gas, Gould couplers, canvas roofs, Railway Steel Spring Co.'s springs and Pullman vestibules.

The Lehigh Valley, as reported in our issue of July 15, has ordered 100 produce cars of 40,000 lbs. capacity from the Standard Steel Car Co. These cars will be built of wood with steel underframes and will be 35 ft. 10 in. long, inside measurement, 8 ft. 4 in. wide and 7 ft. 11¼ in. high under car lines. The special equipment includes: Standard Steel Car Co.'s brake-beams, Westinghouse brakes, Magnus metal brasses, Melrose couplers, Sessions draft rigging, Symington journal boxes, Hutchins plastic roofs and arch-bar diamond trucks.

BRIDGE BUILDING.

ATCHISON, KAN.—Bids will be received by the County Commissioners until August 1 for building a bridge over Stranger Creek in Atchison County. This bridge will have one span 125 ft. long and a 62-ft. approach and will cost between $3,000 and $3,500. Charles Woodworth is County Surveyor.

ATLANTA, GA.—Bids will be received until August 15 for building a new steel bridge over Magnolia street in Atlanta. The bridge will be 282 ft. long.

AUSTIN, TEXAS.—The International & Great Northern, it is said, will soon replace its bridge over the Colorado River with a new steel structure.

CHICAGO, ILL.—Plans for the new $125,000 Archer avenue bridge, to be built out of the proceeds of the coming bond issue of $5,000,000, it is reported have been completed by City Engineer Ericson. Work will be begun about September 1. Plans for the North avenue bridge, to cost $150,000, also are nearly finished.

CHILLICOTHE, OHIO.—Bids are wanted August 1 by C. H. Pinto, Auditor, for building a steel bridge, 140 ft. long and 40 ft. wide, over the north fork of Paint Creek in Ross County.

CINCINNATI, OHIO.—Repairs will soon be made to the Central bridge between this place and Newport over the Ohio River, at a cost of about $100,000. Address Col. R. W. Nelson, care Cleveland Trust Co.

CLARKSBURG, W. VA.—The County Commissioners are considering the question of building a steel bridge over West Fork River, to cost about $11,000.

DOYLESTOWN, PA.—Bids will be received by the Commissioners of Bucks County until August 15 for building a stone arch bridge over Core Creek. T. A. Crouthamel, Doylestown, Pa., is County Clerk.

ELK RIVER, MINN.—Residents have voted to issue bonds for building a bridge over the Mississippi River.

EMPORIA, KAN.—Plans have been made by County Surveyor Alva J. Smith for building several new bridges in Lyon County; a steel bridge at Badger Creek, 54 ft. long; one at Appleby Ford, 70 ft. long, and a 30-ft. stone arch at Duck Creek.

GLASGOW, MONT.—Bids are wanted August 8 by the County Commissioners for building a bridge over Frenchman Creek. R. J. Crossett is Clerk.

LOS GATOS, CAL.—A bridge may be built here, to cost $12,000.

NEWARK, OHIO.—Bids are wanted August 1 by A. R. Pitser, Auditor, for building the superstructure of a bridge in Monroe Township; also one in Newark Township, Licking County.

NEWBERRY, S. C.—The Commissioners of Newberry and Saluda Counties have not determined the site of the proposed new steel bridge over the Saluda River and will receive bids for building it at Kempson's Ferry and at Bouknight's Ferry.

NEWPORT, PA.—The County Commissioners have awarded the contract for a new bridge over the Juniata River to Nelson & Buchanan. The bridge will have four spans and will be 680 ft. long.

NORFOLK, VA.—The Board of Harbor Commissioners has granted permission to the River Front Belt Line to build a bridge with a 35-ft. draw over Scuffletown Creek, near South Norfolk.

NORWICH, CONN.—The War Department has ordered that the New York, New Haven & Hartford iron bridge over the east channel of the Yantic River be removed by October. The railroad may replace it with a drawbridge; the town may also replace the highway bridge over the river by putting in a lift bridge.

OCOTLAN, MEXICO.—The Mexican Central, it is said, will build an iron bridge at Ocotlan, State of Jalisco.

OSHKOSH, WIS.—The Common Council will authorize the issuing of $100,000 of bonds for a new bridge over the Fox River at Main street.

PHILADELPHIA, PA.—The Philadelphia, Baltimore & Washington has been awarded $90,000 for the lengthening of its bridges in the vicinity of Paschalville, near Woodland avenue. An entirely new bridge will be built at that point, replacing the present bridge with a longer structure.

PITTSBURG, PA.—The lowest bid opened by Director E. M. Bigelow, of the Department of Public Works, July 18, for the Wilmot street bridge was that of the Fort Pitt Bridge Co., of $129,146, and that of the same company for the Mission street bridge at $23,972.

PRAIRIE DU CHIEN, WIS.—The City Council will soon ask bids for a steel bridge over the Marias de St. Feriole to replace the present wooden structure.

RIVERSIDE, CAL.—Bids will be received by the Board of Supervisors of Riverside County, California, until August 3 for building a steel bridge across Santa Anna River at West Riverside. W. W. Phelps is County Clerk.

ROCK ISLAND, ILL.—Bids are wanted August 1 by W. Treichler, City Engineer, for building a two-span steel highway bridge over Rock River.

SOUTH BEND, IND.—The County Commissioners, at a recent meeting, it is reported, accepted the plans of City Engineer A. J. Hammond for the new bridge over the river at Jefferson street, which is to be a concrete-steel structure of Melan arch system, to cost about $125,000.

STEAMBOAT SPRINGS, COLO.—Bids are wanted August 9 by L. G. Carpenter, State Engineer, at Denver, for building a bridge over the Yampa River in Routt County.

WASHINGTON, D. C.—The Insular Bureau of the War Department is asking bids for a steel bridge over the Pasig River in Manila; also for nine steel highway bridges from 35 ft. to 100 ft. long in Southern Louisiana.

The Anacostia bridge, on which work is soon to be started, will be built without a draw. The amount available this year for the work is $100,000. The total cost of the structure must not exceed $250,000.

WELLINGTON, KAN.—Bids will be received at the office of the County Clerk until August 22 for building a steel bridge with two 100-ft. spans across the Arkansas River at this point. L. M. Pfeifer is County Clerk.

YORK HAVEN, PA.—The State will rebuild two bridges over Conewago Creek, near this place, which were destroyed by floods last winter. The reports of the viewers were confirmed in the Dauphin County Court.

Other Structures.

AURORA, ILL.—The Chicago, Burlington & Quincy is making plans for building large, new shops north of the present coach shops.

BALTIMORE, OHIO.—It has been announced that the Baltimore & Ohio is about to build a new general office building and additional warehouse facilities in Baltimore, at a cost of from $2,000,000 to $2,500,000.

CHARLOTTESVILLE, VA.—The Chesapeake & Ohio, it is reported, will build a new passenger station, to cost $30,000.

DETROIT, MICH.—Carsheds of the Michigan Central in West Detroit and 90 freight cars were destroyed by fire July 19 at a loss of $70,000.

DU BOIS, PA.—The Buffalo & Susquehanna, it is reported, has bought land on which it will put up buildings to cost about $100,000 to include a new passenger station and freight house.

GOMER PLACIO, MEX.—The Mexican Central will remove its shops and offices now at Jimulco, Coahuila, to this place, on land donated by the government. The buildings to be put up, it is said, will cost about $100,000.

GULFPORT, MISS.—The Illinois Central, it is reported, has bought a plot of ground to be used as a site for a grain elevator and other buildings.

LITTLE ROCK, ARK.—Residents and the City Council are considering the making of preliminary plans to be submitted to the railroads entering the city for a new union passenger station.

MEMPHIS, TENN.—The railroads entering this city are considering the question of jointly building a union passenger station.

MERIDIAN, MISS.—The various railroads entering this city have organized a terminal company to build a new union station at this point at a cost of about $250,000. The company has been chartered and will issue bonds to provide necessary funds for building the station.

NEWBERRY JUNCTION, PA.—The Philadelphia & Reading is receiving bids for a new car repair shop at Newberry Junction. The shop will be 303 ft. long and 118 ft. wide.

NEW HAVEN, CONN.—The New York, New Haven & Hartford will soon begin work on a new station at New Haven. Plans for the station are practically completed. It is to stand on the ground that lies between the present station and the general office building.

NEW YORK, N. Y.—The New York Central & Hudson River has filed plans for building a power house at 149th street, near Long Island Sound. The plans call for a building three stories high, 236 ft. long and 167 ft. wide, which will cost about $500,000. It is to furnish electric power for running the trains on the main line and Harlem division to and from Grand Central Station.

PEORIA, ILL.—The Cleveland, Cincinnati, Chicago & St. Louis, it is reported, has plans ready for building a new brick station with slate roof, 32 ft. wide and 75 ft. long.

PUEBLO, COLO.—The Denver & Rio Grande,

it is reported, will put up large, new machine shops and a roundhouse to hold about 60 locomotives.

VINCENNES, IND.—The Vincennes Bridge Co. will put up a new building, to cost about $10,000.

WASHINGTON, D. C.—The work of excavating for the foundations for the new building for the National Museum will be completed about August 15, and it is expected that the building will be finished in about four years, the appropriation for it being $3,500,000. It will be the largest building in the District of Columbia, except the Capitol, the dimensions being 553 ft. long and 313 ft. wide, exclusive of projections, and four stories high. The design will be classic and the floor area will be 9½ acres. Mr. Bernard Green is in charge of construction and Messrs. Hornblower & Marshall, of Washington, are the architects.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ARKANSAS ANTHRACITE RAILROAD.—Articles of incorporation have been filed by this company in Arkansas. It is proposed to build a railroad from Fort Smith, Ark., through Sebastian, Crawford, Franklin and Johnson Counties to Clarksville, 66 miles. E. E. Miller, J. F. Reid, W. H. Robbins and others, of Fort Smith, Ark., are incorporators.

ATCHISON, TOPEKA & SANTA FE.—According to press reports, this company will soon begin work on a new line from Canyon City, Texas, to Plainview, 100 miles. It is stated that this line will be built to provide for the large increase in immigration to the Southwest during the past year.

BALTIMORE & OHIO.—It has been recently announced that this company will shorten the route between Philadelphia and Pittsburg about 60 miles by building a line from Hancock, W. Va., through Maryland, to Bedford, Pa., where it will reach the roadbed which was made for the South Pennsylvania, but was never used. It will follow this line for 75 miles and will join the present line at Port Perry, several miles east of Pittsburg. The Baltimore & Ohio recently purchased the South Pennsylvania at a foreclosure sale.

BAYFIELD, LAKE SHORE & WESTERN.—Work has been begun on this railroad, which is projected from Bayfield, Wis., west to Superior, 65 miles. The line will be built first to Cornucopia and from there to Superior and eventually to Duluth. R. R. Dunn, St. Paul, Minn., and T. J. Stephenson, Cornucopia, Minn., are interested. (July 15, p. 35.)

BIRMINGHAM & LINEVILLE.—Grading has been completed on this proposed road from Lineville, Ala., west to Pyriton, in Clay County, eight miles, and track laying will soon be begun. Connection will be made with the Talladega branch of the L. & N. at Pyriton. R. L. Ivey, Lineville, Ala., may be addressed. (See Construction Supplement.)

DANVILLE & NORTHERN.—Articles of incorporation have been filed by this company in Illinois to build a railroad from a point in Vermilion County through Iroquois and Kankakee Counties to a point on the north line of Will County. L. E. Fisher, G. L. Buckingham, Robert Parks and others, of Danville, are incorporators.

DE KALB & SOUTHEASTERN.—This company has been incorporated in Illinois to build a terminal connecting railroad in and about De Kalb. A. W. Fisk, E. E. Watson and others, of De Kalb, Ill., are incorporators.

DES MOINES, ALBANY & ST. JOSEPH.—It is reported that surveys will be begun at once on this proposed line between St. Joseph, Mo., and Des Moines, Iowa. The road is projected to run from St. Joseph east to Clarksdale, where it will cross the tracks of the C., R. I. & P., and thence in a northerly direction to Albany, where connection will be made with the C., B. & Q. From there the line will run in a northwesterly direction through Arispe and Creston and will then pass in a northeasterly direction through Macksburg, Winterset and Cummings to Des Moines, Iowa, about 300 miles. F. S. Mordaunt, Chicago, is interested.

DONALDSONVILLE & NAPOLEONVILLE.—According to press reports, work will soon be begun on this proposed line from Johnson, La., 38 miles from New Orleans, through Thibodaux to a point near Houma. Connection will be made with the Texas & Pacific at Johnson. M. D. Bringier, Donaldsonville, La., is interested.

ILLINOIS CENTRAL.—A contract is reported let to Bowles & Hemingway, Jackson, Miss., for building the new branch line from Brookhaven, Miss., to Monticello, in Lawrence County, a distance of 40 miles. Work will be begun at once and the contract calls for the completion of the line by January 1, 1905.

JAMES BAY.—Contracts have been let to Angus Sinclair, A. A. Mann and A. McKenzie for building this road from Toronto to Parry Sound. The contract calls for the completion of the line by September, 1905.

MEMPHIS, INDIANOLA & GULF.—Surveys are reported in progress for this proposed railroad from Memphis, Tenn., through Indianola, Miss., to Jackson. J. H. Baker, Indianola, is interested. (See Construction Supplement.)

MINNEAPOLIS & RAINY RIVER.—Articles of incorporation have been filed by this company in Minnesota. It is proposed to build a railroad from Minneapolis north through Hennepin, Ramsey and other counties to a point on Rainy River, in Itasca County, about 250 miles. The principal office of the company will be in Minneapolis. C. H. Hickley, Muskegon, Mich.; F. G. Gerhard, Minneapolis, and others are incorporators.

NEW YORK CENTRAL & HUDSON RIVER.—This company has completed its cut-off from Curwensville, Pa., to Bower, 15 miles, and it is stated that the line will be open for traffic in a few weeks. This new line will do away with the Bower hill on the present Beech Creek branch.

NEW YORK, NEW HAVEN & HARTFORD.—President Louis Haffen, of the Borough of the Bronx, has signed and approved the plans for changing the Harlem River branch into a six-track road between New Rochelle and the Harlem River and for the elimination of every grade crossing in the Bronx. Under the approved plans, the Harlem River branch will be an elevated structure over all streets from Willow avenue and 131st street to 141st street. This will do away with 10 grade crossings between these points. After crossing the Port Morris branch of the New York Central, the road will be depressed so as to go under all streets south of the Bronx River. It is stated that engineering officers to take charge of the improvements have already been established at New Rochelle.

NEW YORK SHORT LINE (PHILADELPHIA & READING).—A contract has been let to the E. E. Smith Construction Co., of Philadelphia, for building the section of this road between Cheltenham station and Pennypack Creek, 2.6 miles. This is part of the proposed cut-off between Cheltenham and Neshaminy, to be built for the purpose of shortening the line to New York. The contract, which has just been let, requires the excavation of 300,000 cu. yds. of earth and the construction of 15,000 cu. yds. of masonry. The Millard-Graw Construction Co., Philadelphia, is now building the section out of Neshaminy. The contract for the intermediate section has not yet been let, but it is stated that work on this portion of the line will soon be begun. (May 13, p. 376.)

NEW YORK, WESTCHESTER & BOSTON.—The Board of Aldermen of New York City, by a vote of 62 to 8, has approved the franchise which has been asked by this company from the city, the approval of the Aldermen being necessary in order to enable the company to cross a number of streets in the Borough of the Bronx. It is said that the line along which the company proposes to build is wholly on private property except at street crossings. The Aldermen have voted in favor of this franchise once before, but it was vetoed by the Mayor. If the present vote is approved by the Mayor the company promises to begin work at once. A number of the Aldermen explained their vote in favor of this franchise, and their abandonment of opposition to this company in behalf of the rival New York & Port Chester Railroad by saying that the city needs two railroads through the Borough of the Bronx. Both the Westchester and Port Chester companies propose to build from the Harlem River, at or about 129th street, northeastward to the Connecticut line at Port Chester; and the Westchester Co. proposes also to build a branch from Pelham to White Plains, 13 miles, and one to Throgg's Neck, six miles. Dick & Robinson, financial agents of the Westchester Co., have issued a statement saying that the company has the support of a strong syndicate in New York and also financial interests in England. The President of the company is William L. Bull, of the banking house of Edward Sweet & Co. The company intends to bid for the construction and operation of the proposed East Side subway, from the lower end of Manhattan northward through Lexington avenue to the Harlem River. Control of this would enable the company to run trains through from its northern termini to the Battery.

SAN FRANCISCO RAILROAD.—Articles of incorporation have been filed by this company in California. It is proposed to build a street railroad from the foot of Market street, San Francisco, to Ocean Beach, 10 miles. The authorized capital is $1,500,000. J. W. Scott, Oakland, Cal.; L. T. Wagner, J. H. Goldman and others, of San Francisco, are incorporators.

SOMERSET R. R.—Press reports state that surveys are now in progress for an extension from Bingham, Me., at forks of the Kennebec River to Birch Point on Moosehead Lake. These surveys are almost completed and it is stated that contracts for building the line will be let very shortly. W. M. Ayer, Oakland, Me., is Manager.

TENNESSEE CENTRAL.—Press reports state that this company will soon begin work on an extension from Harriman, Tenn., to Kingston, eight miles. It is reported that rights of way are now being secured and that final surveys will shortly be begun.

TONOPAH & TIDEWATER.—Incorporation has been granted this company in New Jersey with an authorized capital stock of $1,000,000. The proposed location of the road is not stated. F. M. Smith, Oakland, Cal., may be addressed.

UNION PACIFIC.—According to press reports, this company will begin work in about six weeks on double-tracking its Kansas division between Kansas City and Topeka. It is stated that the second track will be built on this division to accommodate the increase in traffic due to the use of the tracks by the C., R. I. & P.

WISCONSIN & MICHIGAN.—A contract has been awarded to Lorimer & Gallagher, of Chicago, for building an extension of this road from Nathan, Mich., to the Menominee River, seven miles, where connection will be made with the Holmes logging road, which was recently bought by the W. & M. The contract calls for the completion of the new line within three months. B. C. Gowan is Chief Engineer. (July 15, p. 35.)

RAILROAD CORPORATION NEWS.

BALTIMORE & OHIO.—The gross earnings for the fiscal year ending June 30, 1904, were $65,071,081, an increase of $1,600,305 over 1903. Operating expenses increased $4,044,296, leaving a decrease in net for the fiscal year of $2,443,991. The gross income was $23,951,675, a decrease of $1,544,383, and net income amounted to $12,305,618. In explanation of the large increase in operating expenses, an official statement says: "The past winter, with its floods and heavy snows, made operation slow and expenses

and also caused a heavy decrease in business during the first few months of the year." After payment of all fixed charges, taxes and dividends, the company has a surplus of $5,000,000.

CINCINNATI, BLUFFTON & CHICAGO.—W. S. Fleming has been appointed receiver for this road and J. O. Pierce receiver for the Indiana property of the Bracey Howard Construction Co., of Chicago, which built the road. The company recently completed a line from Bluffton, Ind., to Pennville, 19 miles, and it was the intention to eventually extend the line to Union City. (See Railroad Construction, April 29, p. 314.)

CONSOLIDATED RAILWAY.—According to press reports, the New York, New Haven & Hartford has purchased through its sub-company, the Consolidated Ry., the New London Street, the Norwich Street and the Montville Street Railway Companies. These companies will be taken over and paid for in 50-year 4 per cent. debenture bonds of the Consolidated Ry. Co. The total capitalization of the three street railroads acquired is $1,500,000. (See editorial.)

DES MOINES & FORT DODGE.—An announcement was recently made by Vice-President Day of the Minneapolis & St. Louis that his company has secured possession of the majority of the stock of the Des Moines & Fort Dodge and would take possession of the road in January, 1905, when the lease of the Rock Island expires.

GRAND TRUNK PACIFIC.—The bill to amend the National Trans-Continental R. R. act so as to provide for building the Grand Trunk Pacific is now a law, having received the royal assent on July 18. As finally adopted, the bill provides that that portion of the new line west from Winnipeg to the Pacific Ocean is to be built and operated by the Grand Trunk Pacific, the Canadian Government guaranteeing the bonds up to three-fourths of the cost of the road and the payment of the interest on these bonds for seven years. The bill provides that the division east of Winnipeg shall be built by the Canadian Government; and when completed this part will be leased to the Grand Trunk Pacific at a rental equal to 3 per cent. of the cost of the construction. The lease will run for 50 years, but for the first seven years the lessee will pay no rent. The proposed eastern terminus is Moncton, N. B., but the company will be granted trackage rights over the Intercolonial from that point to St. John, Halifax and Sydney.

LONG ISLAND.—It has been announced that the contract between this company and the New York & Rockaway Beach has been renewed for 50 years. The New York & Rockaway Beach is 12 miles long and runs from Glendale Junction to Rockaway Park and from Hammels Station to New York and Rockaway Beach Junction. The trains of the elevated lines of the Brooklyn Rapid Transit Co. also run over the line in the summer season as far as Rockaway Park.

MEXICAN CENTRAL.—Hallgarten & Co. and Ladenburg, Thalmann & Co., of New York, have purchased $9,000,000 of an issue of $10,000,000 of 2½-year 6 per cent. notes of this railroad. The remaining $1,000,000 notes will be retained in the treasury of the company. The notes are secured by a deposit of $6,000,000 of consol. 4s and a block of Tampico harbor bonds.

MINNEAPOLIS & ST. LOUIS.—See Des Moines & Fort Dodge above.

NEW YORK, NEW HAVEN & HARTFORD.—A circular has been issued calling for proposals for the refunding of $10,000,000 of 7 and 6 per cent. first mortgage bonds of the New York & New England, which mature January 1, 1905. The new bonds are to be 4 per cents., and they will mature July 1, 1945. This refunding issue of $10,000,000 is part of the authorized issue of $17,500,000, of which $5,000,000 is now outstanding. The other $2,500,000 is reserved for additions and improvements.

By a new time-table issued last Sunday the New York, New Haven & Hartford has reduced its passenger train service by taking off about 40 trains. So far as appears from a cursory glance at the new tables, the changes have been made with care and with an intelligent study of the conditions of traffic, with a view to the least inconvenience to the public and to saving mileage on trains paying the least profit. For example, the abolition of evening trains out of New York and Boston is presumably a temporary arrangement designed to last only during the summer, while the evening entertainment season is dull. Local newspapers report, however, that season-ticket passengers complain of much inconvenience as a result of the diminution of their privileges.

NORTHERN PACIFIC.—The annual meeting of the stockholders, which has been adjourned several times since October, 1903, has again been indefinitely adjourned. In explanation, one of the officials of the company has said that the continuation of the injunction recently granted to Messrs. Harriman and Pierce, prohibiting the distribution of the stock owned by the Northern Securities Co., has made it impossible to hold a meeting until this injunction is dissolved, as the charter of the Northern Pacific Co. prohibits the transaction of any business at a stockholders' meeting unless a majority of the outstanding stock is present and voted.

NORTHERN SECURITIES CO.—See Northern Pacific above.

READING COMPANY.—President Baer has officially announced that the voting trust will be terminated on September 10, following the payment of the fourth consecutive semi-annual dividend of 2 per cent. on the first preferred stock. The voting trust was created in 1896 and the voting trustees are J. P. Morgan, F. P. Olcott and C. W. S. Packard. Under the agreement of the voting trust it was provided that the stock should be under the control of the trustees until such time as the dividend of 4 per cent. had been paid upon the first preferred stock for two consecutive years.

ST. LOUIS & SAN FRANCISCO.—President Davidson has announced that the new railroad by which this company, in connection with the Cleveland, Cincinnati, Chicago & St. Louis will have a through line between Chicago and St. Louis, will be opened for traffic on August 1. Through trains will be run in each direction between the two cities on schedules of nine or ten hours. The new route is 291 miles long and is double-tracked throughout.

SIERRA RAILWAY.—A meeting of the stockholders of this company will be held in San Francisco on September 7 to vote on a proposition authorizing an issue of $860,000 5 per cent. 40-year gold bonds to be secured by a mortgage on all the property of the company. These bonds will be exchanged for $1,266,000 outstanding second mortgage bonds at the rate of one new bond for two of the second mortgage bonds. The remainder of the new issue, amounting to $227,000, will be used for completing the road and for the purchase of necessary rolling stock.

SOUTHERN PACIFIC.—At a meeting of the directors, held on July 21, the necessary resolutions were passed for issuing the $40,000,000 of 7 per cent. preferred stock which was authorized by the stockholders on July 20. Stockholders of record July 28 will be entitled to subscribe to the new preferred stock pro rata according to their holdings.

TEXAS SOUTHERN.—S. P. Jones, Marshall, Texas, has been appointed receiver of this road by Judge R. B. Levy on application of the United States & Mexican Trust Co., the mortgage trustee. The amount due under the mortgage, both for principal and interest, is stated to be about $500,000. The company operates a road from Marshall, Texas, to Winnsboro, 24 miles.

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EDITORIAL ANNOUNCEMENTS:

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at 28 Victoria street, London, S. W. It consists of most of the reading pages and all of the advertisement pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name, Transport and Railroad Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

FRIDAY, JULY 29, 1904.

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